Abstracts

Abstract Number	**O-1-07-01**
Presenter	Daniel Oudin Åström*, Bertil Forsberg, Kristie Ebi, Joacim Rocklöv
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Attributing extreme temperature-related mortality to climate change in Sweden

Attributing extreme temperature-related mortality to climate change in Sweden Background: Climate change is projected to increase extreme weather events. Evidence of health impacts attributable to historic changes in climate is limited. Aim: We aim to attribute temperature-related mortality to changes in the frequency of temperature extremes due to climate change. Methods: We collected daily temperature data for the period 1900-2009 and daily mortality data for the period 1980–2009 in Stockholm, Sweden. The relationship between extreme temperatures and all-cause mortality was investigated through time series modelling, adjusting for time trends. Attribution of mortality to climate change was calculated using the relative risks and baseline mortality during 1980-2009 and the number of excess extreme temperature events occurring in the last 30 years as compared to our baseline period 1900-1929. Results: Mortality from heat extremes doubled due to warming associated with climate change. The number of deaths attributable to climate change over the last 30 years due to excess heat extremes in Stockholm was estimated to be 323 (95% CI: 184, 465) compared with a reduction of 82 (95% CI: 43, 122) lives saved due to fewer cold extremes. Conclusions: Mortality due to heat extremes in Stockholm, Sweden increased significantly in the last thirty years because of more frequent events compared to the beginning of the 20th century. Cold spells occurred less frequently, slightly reducing mortality during winter months.

Abstract Number	**O-1-07-02**
Presenter	Yeonseung Chung*, Youn-Hee Lim, Yasushi Honda, Yue-Liang Guo, Masahiro Hashizume, Bing-Yu Chen, Ho Kim
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	time series study

Time-varying high temperature effects on mortality for 15 cities in East Asia

Background and Aims: Although numerous studies have shown that high temperatures are related to increased mortality worldwide, little research has investigated whether or not the association may vary over time, in particularly, decrease over time because of human adaptation to hot weather. We examined time-varying mortality risks associated with hot temperature for 15 cities in East Asia. Methods: Data for mortality and weather variables were collected for 15 cities in the East Asia for the last decades (Taipei, Taichung, Kaoshiung in Taiwan, Seoul, Incheon, Daejeon, Daegu, Gwangju, Pusan in Korea, and Sapporo, Sendai, Tokyo, Osaka, Nagoya, Kitakyushu in Japan). We examined time-varing association between high-temperatue and mortality using a generalized additive poisson regression. The temperature-mortality relationship was modeled nonlinearly using a natural cubic spline basis and the time-varying coefficients for the basis are also modeled semiparametrically. City-specific estimates for time-varying temperature-mortality relationship curves were obtained and we pooled them to obtain country-specific estimates using a Bayesian hierarchical method.Results: Hot temperature-related mortality risk was defined as % increase in mortality for the 90th vs 99th percentiles of temperatures of each city. For cities in Japan, about 20-25% increases were estimated in 1970's and the risk has decreased in a quadratic shape down to 5-10% in 2000's. In Taiwan, the mortality risk was about 4-7% in 1990's and decreased to 1-4 % in 2000's. In Korea, 5-15% increases were found in 1990's and <5% were estimated in 2000's with some variations among cities.Conclusions: This research showed that high-temperature effects on mortaity have decreased over the last decades for 15 major cities of Japan, Korea, and Taiwan in the East Asia. Study results imply that the study population has adapted well to hot weather for the past decades and such findings should be considered for the estimation of the health risks related to global warming.

Abstract Number	**O-1-07-03**
Presenter	Shilu Tong*, Xiaoyu Wang, Weiwei Yu, Dong Chen, Xiaoming Wang
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	time series study

The impact of heatwaves on mortality in Australia: a multi-city study

Background: It is important to quantify the health impact of heatwaves. However, little is known about the geographic difference of the heatwave - mortality relationship in the southern hemisphere. This study assessed the impact of heatwave on mortality in three major Australian cities: Brisbane, Melbourne and Sydney. Methods: Daily data on climatic variables and mortality for these three cities during the period 1988 to 2009 were obtained from relevant government agencies. A consistent definition of a heatwave was used for these cities. Generalized additive Poisson regression models were fitted to assess the impact of heatwaves on mortality after adjustment for confounders. Results: Total mortality increased mostly within the same day (lag 0) or a lag of one day (lag 1) during almost all heatwaves in three cities. Using the 95 percentile of mean temperature for two or more consecutive days in the summer season as a consistent heatwave definition (HWD) across different cities, the relative risk for total mortality at lag 1 in Brisbane, Melbourne and Sydney was 1.13 (95% confidence interval (CI): 1.08 – 1.19), 1.10 (95% CI: 1.06 – 1.14) and 1.06 (95% CI: 1.01 – 1.10), respectively. Using the more stringent HWD, i.e. the 99 percentile of mean temperature for two or more consecutive days in the summer season, the relative risk of total mortality at the lags of 0-2 days in Brisbane and Melbourne was 1.40 (95% CI: 1.29 – 1.51) and 1.47 (95% CI: 1.36 – 1.59), respectively, indicating significant increases in mortality risk. Elderly, particularly females, were more vulnerable to the impact of heatwaves. Conclusions: A consistent and significant increase in mortality was observed during heatwaves in three major Australian cities, but the impacts of heatwave varied with age, gender, the HWD and geographic area.

Abstract Number	**O-1-07-04**
Presenter	Francesca de Donato*, Michela Leone, Antonis Analitis, Timo Lanki, Christofer Åström, Ferran Ballester, Xavier Basagaña, Anna Páldy, Damia Noce, Paola Michelozzi
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Temporal variations in the association between cold and mortality in 8 European cities. Results from the PHASE project

Background:In recent years, greater attention has been paid to the health effects of heat, while less has been done in terms of the health effects of cold in Europe. Aim: The study aims to estimate the effect of cold on mortality and evaluate the latency of the effect in European cities and possible temporal variations. Methods: The association between daily total mortality and cold was analyzed in 8 European cities (Athens, Barcelona, Budapest, Helsinki, Paris, Rome, Stockholm, Valencia) in two study periods (1996-2002 and 2004-2010). Minimum apparent temperature (Tappmin) was considered as exposure. City-specific analyses were carried out using distributed lag non-linear models, to estimate the overall risk in mortality comparing tappmin at the 50th to the 10th percentile of the winter (December-February) distribution. The potential differences in the delayed effect of cold temperatures on cardiovascular and respiratory causes by age groups were also investigated. Results: Mean temperatures were similar in the two periods but variability showed an increase over time. A reduction in the effect was observed in Athens, Barcelona, Budapest and Stockholm in recent years (reduction comprised between -33% and -4%), while in Helsinki and Rome the effect was slightly higher (+5%). A variation in the lag structure was observed in most cities between the two periods; in Athens, Budapest, Paris, and Stockholm a shorter lag was detected in recent years while in Rome and Barcelona the effect was more delayed. Conclusions: A temporal variation in the delayed effect of cold was observed in the European cities included in our study. Although a reduction in the cold effect was observed in most cities, the increase in the effect in cities where exceptional cold temperatures have become more frequent suggesting a greater susceptibility among populations not acclimatized to these climatic conditions. In conclusion it seems important to invest in public health measures to reduce the effects of cold.

Abstract Number	**O-1-07-05**
Presenter	Michael Friger*, Annibale Biggeri, Arkady Bolotin, L. Tzivian, Michela Baccini
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

The Effect of Heat Stress on Daily Mortality in Different Age and Ethnic Population Groups in the Beersheba Region, Israel

Background Since nowadays climate is changing, the impact of heat stress (HS) on mortality is a matter of increasing interest. Recent studies show that HS being described thru such factors as apparent temperature and discomfort index (DI) is associated with mortality in different regions. Therewithal, understanding the impact of these and other HS factors on different population groups in various world's regions is still limited. Aims To study and to assess associations between HS effect and all mortality causes for different age and ethnic groups in the city of Beer Sheva, Israel, and the suburb area. Methods and statistical analysis All natural causes of daily mortality rates (ANMR) in 65- and 65+ age groups were analyzed for Jewish and Bedouin populations over 1997-2010 years. As factors described HS, we took daily DI readings and the maximum-minimum difference of daily temperature (DMM). Also daily values of relative humidity and PM10, NOx, and SO2, concentrations were included. To estimate the rate ratio of HS-caused incidences, controlled for seasonal factors and pollutants, we applied a multivariate time series-based Poisson regression that was realized using the broken line linear spline of DI at 24°. Results HS effects have been found nonexistent in 65- age groups. In contrast, in 65+ age groups, an increased ANMR were found for DI in Jewish (IRR=1.01 95%CI 1.001-1.021, p<0.02) and in Bedouin populations (IRR=1.04 95%CI 1.03-1.05, p<0.01). We observed a large HS effects by DMM in Bedouin population aged 65+. Namely, for DMM staying between 5° and 10°, IRR=1.36 (95%CI 1.26-1.48, p<0.01), for DMM=10°¸15° IRR=1.40 (95%CI 1.33-1.48, p<0.01). Furthermore, in either ethnicity group aged 65+, significant HS effects were found for ANMR lagging 1, 2 and 3 days. Conclusion As it appears, HS-caused mortality risk is associated with age and ethnicity. There exists both immediate and delayed HS effects in old population groups.

Abstract Number	**O-1-07-06**
Presenter	Wen-Chi Pan*, Mu-Jean Chen, Huey-Jen Su
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Association between Daily Temperature Variability and Short-term Mortality in 6 Taiwan Major Cities

Background:Previous studies have evidenced that temperature and extreme weather (e.g. heat waves) are associated with increased risks of mortality. However, only limited studies focused on the temperature variability and its impacts on human health. Given the facts that climate change is predicted to increase the temperature variation, it becomes imperative to explore the role of temperature variability on human adverse effects. Aims:Assess the association between daily temperature difference (maximum temperature subtracted by minimum temperature) and short-term mortality. Methods:Death certification and meteorological data in 6 Taiwan major cities from 1994-2008 were extracted from Central Weather Bureau and Department of Health. Monitoring record of air pollutants was obtained from Taiwan Environmental Protection Administration. A two-stage time-series analysis was performed to assess the association between daily temperature difference and mortality. Poisson regression models were used to estimate city-specific relative risks of mortality associated with daily temperature difference. Random effect relative risks were reported for the national-wide estimate of the association between daily temperature difference and mortality. Results:1 degree (Celsius) increase in daily temperature difference was significantly associated with daily mortality (relative risk [RR], 1.007; 95% confidence intervals [CIs], 1.003 - 1.012). Results were robust to adjustment for ozone, particulate matter, and degree of freedom for time variables. Additionally, this positive association was also observed on cardiovascular mortality (RR, 1.004; 95% CIs, 0.997 – 1.011) and respiratory mortality (RR, 1.006; 95%CIs, 0.996 – 1.017) although they did not reach the statistical significance. Conclusions:Daily temperature variation is associated with elevated risks of mortality. These results suggest that under the scenario of climate change, public health professional may take precautionary actions to reduce adverse health effects attributable to temperature variability.

Abstract Number	**O-1-09-01**
Presenter	Joseph Braun*, Amy Kalkbrenner, Allan C. Just, Kimberly Yolton, Antonia M. Calafat, Andreas Sjodin, Russ Hauser, Glenys Webster, Aimin Chen, Bruce Lanphear
Exposure	persistent organic pollutants
Health domains	neurodevelopment
Type of research	cohort study

Gestational endocrine disrupting chemical exposure and autistic behaviors in 4 to 5 year old children from Cincinnati OH

Background: Endocrine disrupting chemicals (EDCs) may increase the risk of autism, possibly by perturbing fetal hormone signaling or metabolism, but this complex exposure mixture makes identifying the most relevant EDCs difficult. Aims: To identify gestational EDC exposures associated with autistic behaviors. Methods: We measured the concentrations of 52 EDCs including 8 phthalate metabolites, bisphenol A (BPA), 25 polychlorinated biphenyls (PCBs), 6 organochlorine pesticides, 8 brominated flame retardants, and 4 perfluorinated chemicals in blood or urine samples from 175 pregnant women from the HOME Study (Cincinnati, OH). When children were 4 and 5 years old, mothers completed the Social Responsiveness Scale (SRS), a valid/reliable measure of autistic behaviors including interpersonal behavior/communication deficits and repetitive/stereotypic behaviors (mean:50, SD:10). We estimated the association between SRS scores with increasing EDC concentrations using a 2-stage semi-Bayesian hierarchical analysis to adjust for sociodemographic, perinatal, and maternal factors, as well as co-pollutant confounding. Results: The absolute difference in SRS scores associated with most EDCs was negligible (~1 point). Notable exceptions included better SRS scores among children born to women with detectable vs. non-detectable serum PCB-178 (beta:-3.3; 95% confidence interval [CI]:-6.5, -0.1) or b-hexachlorocyclohexane (beta-HCH) concentrations (beta:-3.0; CI:-5.8, -0.2), and increasing serum perfluoroctane (PFOA) concentrations (beta:-1.9; CI:-4.3, 0.5). Higher serum polybrominated diphenyl ether-28 (PBDE-28; beta:2.5; CI:-0.6, 5.6) and trans-nonachlor (beta:4.0; CI:0.7, 7.2) concentrations were associated with worse SRS scores. Conclusion:Although our modest sample size precludes us from dismissing chemicals as risk factors for autistic-like behaviors, we conclude that beta-HCH, PCB-178, PBDE-28, PFOA, and trans-nonachlor deserve additional scrutiny as factors that may increase or decrease the risk of autism in children.

Abstract Number	**O-1-09-02**
Presenter	Aimin Chen*, Kimberly Yolton, Stephen Rauch, Glenys Webster, Richard Hornung, Andreas Sjodin, Kim Dietrich, Bruce Lanphear
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Cognitive Deficits and Behavior Problems in Children with Prenatal PBDE Exposure

Background: Polybrominated diphenyl ethers (PBDEs) are flame retardants that are persistent chemicals and potential developmental neurotoxicants, but the impact on child neurodevelopment remains unclear. Aim: To investigate the association between prenatal exposure to PBDEs and child neurodevelopment Methods: We measured maternal serum concentrations of BDE-47, -99, -100, and -153 in 309 women at 16 weeks of gestation and followed their children until 5 years of age in the HOME Study based in Cincinnati, OH. We examined cognitive and motor abilities using the Bayley Scales of Infant Development-II at ages 1, 2, 3 years, and intelligence using the Wechsler Preschool and Primary Scale of Intelligence-III at age 5 years. We measured behaviors using the Behavioral Assessment System for Children-2 annually at ages 2-5 years. Results: The geometric mean of sum4BDEs was 37 ng/g lipid, with BDE-47 at 20 ng/g lipid, comparable to the 2003-2004 US adults national average. In covariate-adjusted linear mixed models, a 10-fold increase in maternal PBDE concentration was related to a decrement in Wechsler Full Scale IQ at age 5 years (-4.5 points, 95% CI: -8.8, -0.1 for BDE47, and -4.4 points, 95% CI: -8.9, 0.1 for sum4BDEs). The associations between PBDE exposure and cognitive and motor skills from 1 to 3 years were not significant. Prenatal PBDE exposure was associated with hyperactivity at ages 2-5 years, for example a 3.3 point (95% CI: 0.3, 6.3) score increase at age 5 years for each 10-fold increase in maternal BDE-47. Conclusions: Prenatal exposure to PBDEs, detectable in virtually all US people, was associated with cognitive deficits and hyperactivity behaviors in children.

Abstract Number	**O-1-09-03**
Presenter	Malin Larsson*, Huan Shu, Cecilia Boman Lindström, Carl-Gustaf Bornehag
Exposure	household air pollution
Health domains	neurobehavioral effects
Type of research	cohort study

Exposure to PVC-flooring in early life and associations with intellectual skills 10 years later

Background:Epidemiological studies have shown that exposure to suspected endocrine disrupting chemicals (EDCs) may relate to several adverse health outcomes in children. Studies show that exposure to EDCs in foetus and infancy period may give rise to health effects later on in life. There is a growing concern about how EDCs can affect intelligence and learning disabilities. Studies have shown inverse associations between prenatal phthalate exposure and behavior and intellectual related problemsAim:To investigate if PVC flooring in the home of children at the age of 1-5 years is associated with intellectual skills 10 years laterMethods:The DBH study started year 2000 in Värmland, Sweden, with a baseline questionnaire to the parents of 14,077 children age 1-5 years. Ten years later, a follow-up questionnaire was sent out to all children where 7,806 responded. Parental reported PVC exposure in the baseline questionnaire and reported intellectual skills (difficulties in concentration, learning, language and interaction with adults/children) ten years later were investigated. Analyses were adjusted for age, sex, smoking in the family, single parenthood, multi-family housing and mothers educationResults: In trend and crude analysis, PVC flooring in the parents' bedroom (when compared with other flooring types) was associated with more difficulties in concentration, language and learning 10 years later. In adjusted analyses, significant associations remained for learning difficulties. When stratifying for sex, the association for learning difficulties was only seen for girls and in the parents' bedroom (aOR 1.69; 1.13-2.51) compared with the child's bedroom (aOR 1.21; 0.80-1.81). Conclusions: One explanation for the association to PVC flooring in the parent´s bedroom may be that this is representing the exposure during pregnancy while PVC exposure in the children´s bedroom is more of a postnatal exposure. These results indicate that prenatal exposure to phthalates might affect intellectual skill development later in life

Abstract Number	**O-1-09-04**
Presenter	Jonathan Chevrier*, Robert B. Gunier, Kim Harley, Asa Bradman, Andreas Sjodin, Dana Boyd-Barr, Brenda Eskenazi
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Interaction of DDT/E and PBDE in their association with cognition and behavior in 7-year old CHAMACOS children

Background: Pre- and postnatal exposure to the organochlorine insecticide dichlorodiphenyl trichlorethane (DDT), its breakdown product dichlorodiphenyl dichloroethylene (DDE), and polybrominated diphenyl ether (PBDE) flame retardants has been associated with adverse effects on neurobehavioral development but few studies have investigated whether these chemicals interact synergistically. Aim: To evaluate whether DDT/E and PBDE interact in their association with cognition and behavior in 7-year old children. Methods: We measured the concentration of DDT, DDE and four major PBDE congeners (BDE-47, -99, -100, and -153) in serum collected from 257 pregnant women (mean=26 weeks' gestation) and 264 7-year-old children participating in the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS). We assessed cognition, behavior and motor function in CHAMACOS children at 7 years of age using the Wechsler Intelligence Scale for Children (WISC), the Behavioral Assessment System for Children (BASC) and the Wide Range Assessment of Visual Motor Ability (WRAVMA), respectively. Results: As previously reported, prenatal exposure to PBDEs was associated with impaired cognition, attention and fine motor coordination. Although associated with none of the neurobehavioral outcomes at 7 years of age, maternal DDT/E appeared to potentiate the association between PBDEs and fine motor coordination (βInter=-1.7; 95%CI=-3.6, 0.3) and teacher report of internalizing problems (βInter=4.9; 95%CI=0.8, 9.1), particularly for anxiety (βInter=4.5; 95%CI=0.4, 8.7) and somatization (βInter=6.7; 95%CI=2.1, 11.3). For instance, maternal PBDE concentrations were associated with a 8.2 points (95%CI: 0.4, 16.1) increase in scores on the BASC somatization problems scale at the 95th percentile of maternal DDT but not at the 50th percentile of maternal DDT (β=-4.6; 95%CI=-9.2, 0.1). We found no evidence of interaction for postnatal exposure. Conclusion: DDT and PBDE may affect child behavior in a synergistic manner.

Abstract Number	**O-1-09-05**
Presenter	Wilfried Karmaus*, Wei-Wen Hsu, Janet Rose Osuch, David Todem, Bonita Taffe, Michael O'Keefe
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	cohort study

DDE and PCB serum concentration in maternal blood and their adult female offspring

Background: Dichlorodiphenyl dichloroethylene (DDE) and polychlorinated biphenyls (PCBs) can be passed from mother to offspring through placental transfer or breast feeding. Aim: To test whether maternal serum levels of DDE and PCB can predict concentrations in adult offspring. Methods: The Michigan Fisheaters' Study includes mothers and their offspring. DDE and PCB concentrations were determined in 136 adult daughters of Michigan fisheaters. Prenatal exposures were estimated based on the DDE and PCB serum levels of their mothers measured between 1973 and 1991. To investigate the transfer of these chemicals, linear mixed effects models are applied. Adult levels (wet-based and lipid-adjusted) in female offspring are regressed on estimated perinatal or maternal serum concentrations in 1979-1982 or 1989-1991, adjusting for potential confounders. Results: DDE concentrations in offspring after, on average, 40 years are primarily attributable to maternal or perinatal serum levels, age, and birth order. For PCBs, maternal and prenatal levels and fish consumption, in that order, contributed to adult concentrations in female offspring. Conclusion: Maternal exposure to DDE and PCB in the last century seems to have introduced an exposure disadvantage in their adult offspring.

Abstract Number	**O-1-09-06**
Presenter	Marc-Andre Verner*, Jaime E. Hart, Sharon K. Sagiv, David C. Bellinger, Larisa M. Altshul, Susan A. Korrick
Exposure	organic compounds
Health domains	neurobehavioral effects
Type of research	cohort study

Prenatal, but not Postnatal, Exposure to Polychlorinated Biphenyls (PCBs) is associated with ADHD-Related Behaviors in 8-Year-Old Children

Background: The neurotoxicity of prenatal PCB exposure has been established in both animal and human studies. Conversely, few human studies have replicated the behavioral effects of postnatal exposures that have been observed in monkeys, possibly because of challenges to postnatal exposure estimation. To refine exposure assessment, we previously developed and validated a pharmacokinetic model to estimate children's PCB-153 levels across development. Aims: To assess whether postnatal exposure to PCBs, estimated using a pharmacokinetic model, is associated with ADHD-related behaviors in 8-year-olds enrolled in a birth cohort study of prenatal contaminant exposure and subsequent child development. Methods: We used a published pharmacokinetic model to estimate monthly PCB-153 levels in children through 12 months of age based on parameters such as breastfeeding, cord serum PCB-153 levels and growth. Behavior was evaluated using the Conner's Rating Scales for teachers (CRS-T). The associations between PCB-153 levels and 4 CRS-T indices were assessed using multivariable quantile regression at the 50th and 75th percentiles, where higher percentiles reflect worse behavior. Results: Cord serum PCB-153 levels (median: 39 ng/g lipids, 5th-95th percentile: 7-317) were associated with ADHD-related behaviors, although statistical significance was only observed with quantile regression models at the 75th percentile. This association decreased in strength with later postnatal levels. For example, the 1.5 point (95 % CI: 0.3, 2.1) increase in Conner's ADHD index score associated with an inter-quartile range change in cord serum PCB-153 levels weakened to 0.9 (95 % CI: 0.1, 3.0) and 0.1 (95 % CI:-0.3, 2) for estimated children's levels at 2 and 12 months, respectively. Conclusions: Results suggest that the association between PCBs and behavior in 8-year-olds is mainly attributable to prenatal exposure and is more evident in children with worse behavioral scores.

Abstract Number	**O-1-10-01**
Presenter	Jenna Hua*, Lemuel Wu, Puiyin Wong, Victor Shia, Aaron Bestick, Sue Eom, Yan Li, May Wang, Edmund Seto
Exposure	food
Health domains	obesity
Type of research	exposure measurement

Smartphone-based Assessment of Food Environment Exposures and Dietary Intake

Background: Worldwide over one billion adults are overweight. Lack of access to a diverse food environment may limit dietary choices and contribute to obesity risk. Current diet assessment instruments lack geospatial data needed to assess exposures to different food establishments. Smartphones are increasingly ubiquitous technologies that offer the potential for integrated diet and food environment exposure assessment. Aims: We developed the CalFit smartphone app, which measures time-location patterns of users with GPS, physical activity with accelerometry, Ecological Momentary Assessment (EMA), and diet with voice-annotated videos of meals. Methods: The CalFit diet assessment tool was deployed in a pilot study of 12 young adults over a 1-week period in Kunming, Yunnan, China. Subjects recorded smartphone videos of their meals, and completed EMAs before and after each meal for three of the days. Videos were evaluated by trained dietitians to assess nutrient content. Exposure to food environments was measured by mapping each subject's GPS time-location data in relation to spatial data on food establishments, and computing the number of establishments within a 0.36 km2 buffer of each location where >10 mins of time were spent. Results: Among subjects, average daily caloric intakes ranged from 520 to1480 kcal, and energy expenditure ranged from 1.9 to 3.6 kcal/min. Over the 1-week period, subjects' access ranged from 36 to 267 unique food establishments. Caloric intake was positively correlated with energy expenditure (r = 0.11). Exposure to food establishments was inversely correlated with caloric intake (r = -0.17). Of the meals associated with "happiness" in EMAs, 70% occurred with friends and family. Conclusions: Findings demonstrate the use of smartphones for providing integrated measures of diet, time-location patterns, social and emotional context, and food environment exposures for epidemiologic studies.

Abstract Number	**O-1-10-02**
Presenter	June Soo Park, Robert Voss, Sandy McNeel, Yunzhu Wang, Tan Guo, Rupali Das, Leslie Israel, Myrto Petreas*
Exposure	persistent organic pollutants
Health domains	other
Type of research	occupational study

ASSESSING EXPOSURES TO PERSISTENT ORGANIC POLLUTANTS IN A GROUP OF CALIFORNIA FIREFIGHTERS

Background.Firefighters are likely to be exposed to a variety of toxic chemicals, including persistent organic pollutants (POPs), while responding to structural, vehicular or wildland fires or to industrial accidents and chemical spills. While previous studies have measured chemicals at fire sites, few have evaluated serum concentrations of POPs in firefighters. Aim. This pilot biomonitoring study assessed body burdens of selected POPs in a group of California firefighters and tested protocols that could be used in larger occupational biomonitoring studies. Methods. In 2010-11we recruited, interviewed and collected blood samples from 101 Southern California firefighters. Serum was separated and analyzed for polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) by gas chromatography/high resolution mass spectrometry using isotope dilution. Questionnaire data were analyzed using SAS. Results. All chemical classes were detected in all samples. Median concentrations (all in ng/g lipid) ranged from 1-182 for OCPs; 1-15 for PCBs and 1-30 for PBDEs. Most samples (75% and 90%, respectively) exceeded the 50th percentile of NHANES (2003-04) for PBDE-47 and PBDE-153, and 4% exceeded the 95th percentile for both. Correlations between PCBs and OCPs were moderate while PBDEs showed low and statistically non-significant correlations with PCBs or OCPs, pointing to non-dietary exposure routes for PBDEs. PCB and OCP concentrations were highest among older participants, while concentrations of almost all PBDEs were highest in those with 10-20 years of firefighting experience. Preliminary analyses showed certain practices such as use/storage of protective equipment and duty assignments to be associated with elevated serum PBDEs. Conclusions. In this pilot study PBDE concentrations in firefighters' serum were the highest yet measured in California adults, known for high levels of flame retardants.

Abstract Number	**O-1-10-03**
Presenter	Susanne Hesse*, Katrin Schröder, Stefan Hahn, Inge Mangelsdorf, Judith Lamb, Martie van Tongeren
Exposure	others
Health domains	no health domain
Type of research	exposure modeling

Evaluation of Tier 1 Exposure Assessment Models: Conceptual evaluation and uncertainty analyses

Background/Aims In the context of REACH (Registration, Evaluation, Authorization, and restriction of Chemicals), risk characterisations, hazard and exposure assessment are needed for the registration process. The exposure estimates for workers are often modelled with simple (lower tier 1) exposure assessment tools. Although many of these tools are generally accepted, no comprehensive evaluation of the tools has been carried out. The ETEAM project (Evaluation of Tier 1 Exposure Assessment Models) aims to evaluate the concept, uncertainty, reliability and user friendliness of occupational tier 1 exposure tools which are used in REACH context (RISKOFDERM, Stoffenmanager, ECETOC TRA, MEASE, EMKG-Expo-Tool). This presentation will summarise results of the conceptual evaluation and the uncertainty analyses. Methods/Results The conceptual evaluation of each of the exposure tools is based on a summary of the structure of use (i.e. layout, way of handling), model input parameters, algorithm, the tools' scope, underlying datasets and the models' transparency, i.e. the documentation of background information. Data gaps and inconsistencies of documentation or model algorithm are indicated and compared for all models. To evaluate the uncertainty of the exposure models sources of uncertainty related to the model equation or the implemented parameters will be identified. They will be categorised (e.g. in terms of transparency, the underlying knowledge base, vagueness and the impact on the exposure result), summarised and discussed in a qualitative way for each tool. As each of the evaluated tools is unique concerning scope, model algorithm and tool handling the choice of the most suitable tool depends heavily on the exposure situation as well as personal preferences. The results of the ETEAM project will help users to choose the appropriate tool for their situation, to understand the underlying principles of the model algorithms and to avoid application errors.

Abstract Number	**O-1-10-04**
Presenter	Veronika Fensterer*, Helmut Küchenhoff, Verena Maier, Mike Pitz, Josef Cyrys, Susanne Breitner, Alexandra Schneider, Uta Geruschkat, Annette Peters
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure modeling

Data-driven flexible modelling approach for the personal exposure to particle number concentration

Individual exposure to air pollution is associated with several time and location specific factors like ambient air pollution, meteorology, environmental conditions or activities. Our investigation aims at the description and identification of factors determining personal exposure to particle number concentration (PNC) in everyday situations. In a validation study of the Augsburger Umweltstudie in 2011, PNC and particle mass concentrations of various particle sizes and black carbon were collected at a central measurement site. Additionally, ten volunteers recorded their personal exposure to PNC, meteorological parameters, their activities and whereabouts. Measurement campaigns were conducted in three different seasons, each lasting three weeks. Each individual accomplished three scenarios within five to six hours, which include both indoor and outdoor microenvironments in everyday situations. A two-stage approach allowed us to separate the background exposure from the activity effects. Background exposure was modelled with semi-parametric regression and variable selection via boosting. In the second step, the effects of the activities were calculated adjusting for the background exposure from the first step. Separate models were calculated for indoor and outdoor exposure and for the different seasons. Personal indoor exposure exhibited strong individual specific variation; PNC levels were magnified through smoke of candles by 12.6 or through cooking activities by 8.7. In spring, ambient temperature and exposure showed relevant effects. Outdoor personal exposure was mainly influenced by ambient exposure levels; dew point temperature showed a negative almost linear effect in winter. Public transport was figured out as the means of transport with the lowest personal PNC levels, followed by pedestrian and car. The complex modelling strategy enabled the simultaneous examination of the ambient and individual specific influencing factors of personal exposure to PNC.

Abstract Number	**O-1-10-05**
Presenter	Kirsten A. Koehler*, Nicholas Good, Brianna Moore, Christian L'Orange, Maggie L. Clark, Ashleigh Kayne, Amy Stuart, Jennifer L. Peel, John Volckens
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

A Holistic Approach to Microenvironmental Exposure Assessment: Home, Work, and Commute Personal Exposures to Particulate Air Pollution

Background: Air pollutant concentrations vary temporally and spatially and, as such, regional outdoor air monitors do a poor job of representing personal exposures indoors and outdoors. Because particles from different sources may have different toxicity in terms of human health, the ability to apportion human exposure to different sources of air pollutants is desired. Aims: The goal of this study is to assess within- and between- person variations of microenvironmental exposures in Fort Collins, Colorado. We are examining home, work, and commute personal exposures for each participant for a total of 200 sampling days. Methods: Participants of the Fort Collins Commuter Study were outfitted with a backpack containing direct-reading monitors to estimate concentrations of fine particulate matter (PM2.5 mass), PM2.5 black carbon, and ultrafine particle number concentration for 24 hours. Participants filled out daily surveys about job classification, time spent cooking, passive smoke exposure, and whether windows/doors were open or air conditioning was operating in their workplace or home. By pairing personal monitors with a GPS receiver, we are able to link exposures with microenvironment, sources and activities. A Bayesian framework was used to describe the distributions of personal exposures and the factors that contribute to within- and between- person variability. Results: Commute and home exposures accounted for approximately 60% and 25% of total PM2.5 black carbon exposures and 40% and 50% of total PM2.5 mass exposures, respectively. We will present model results that describe variability within- and between- participants for all microenvironments, as well as the factors that influence variability. Conclusions: We developed a time-resolved personal exposure dataset characterizing the magnitude and variability of indoor and commute exposures to particulate air pollution. Using this dataset we developed an innovative modeling system for estimation of personal pollutant exposures, incorporating multiple types of data (monitoring and questionnaire).

Abstract Number	**O-1-10-06**
Presenter	Robin Riedmann*, David Vernez, Bojan Gasic
Exposure	others
Health domains	other
Type of research	exposure modeling

Translating exposure determinants between exposure models. Is it consistent?

Occupational exposure models are frequently used for exposure assessment in the context of the European Union regulation on the Regulation, Evaluation, Authorization and Restriction of CHemicals (REACH). Two different models will usually produce different estimates with large uncertainties for the same exposure conditions. Generating a reliable risk profile for a chemical and interpreting the exposure estimate adequately is a challenge. The selection of the modeling tool and entry parameters is therefore of essence. Here, a translation between three models commonly used within the REACH framework is presented: ECETOC TRA v3, Stoffenmanager 4.5 and Advanced REACH Tool (ART) 1.0. The translation is implemented in the mathematical modeling language Coloured Petri Nets (CPN Tools, University of Aarhus). Each exposure model was rebuilt in CPN Tools and then the translation was built into the program, connecting the models with each other. The workflow is as follows: First, one of the three models is chosen to assess an exposure estimate. Each decision or input parameter in the model is also translated to the corresponding decision in the other two models. The translation has been tested with measured exposure data. Occupational exposure data ware obtained from Schweizerische Unvallversicherungsanstalt (SUVA). Only personal inhalation exposures related to either single or multiple activities were considered. In total, 700 measurements were available. The new tool has several advantages: i) the ECETOC TRA, Stoffenmanager and ART occupational exposure models can be used in a single software, ii) the exposure estimate for all three models is given with a single set of exposure determinants, iii) the tool allows a systematic comparison of the exposure estimates and iv) reduces the inter-user variability. With the validated translation more confidence in the exposure estimate is gained and a weighting of model results may be advised. Examples will be given.

Abstract Number	**O-1-11-01**
Presenter	Paul T.J. Scheepers*, Jeroen J. de Hartog, Judith Reijnaerts, Gwendolyn Beckmann, Rob B.M. Anzion, Lode Godderis, Katrien Poels
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Evaluation of the influence of a combined low-dust carpet and air filtration intervention on the indoor air quality in a primary school

Background Schools in neighborhoods with poor ambient air quality and/or high noise levels cannot rely on natural ventilation to improve indoor air quality (IAQ). Since 40 % of primary schools in The Netherlands do not have a ventilation and filtration system, there is interest in alternative solutions. Laboratory tests show promising results for low-dust carpets and compact air filtration systems but there is no information on the performance of such interventions from in situ tests. Aim To evaluate the combined effect of a low-dust carpet and a compact air filtration system on the IAQ in a classroom. Methods IAQ measurements were performed in two classrooms, each occupied by 27 children. Measurements of PM-10 and PM-2.5 were performed by filter sampling and by aerosol spectrometry. Other parameters included black smoke (BS), volatile organic compounds (VOC), NO2 and formaldehyde. Both interventions were introduced in one classroom during one week, using the other classroom as a reference. In a second week the interventions were moved to the second classroom using the first as a reference. In three additional weeks the classrooms were compared without interventions. An evaluation of the interventions in an unoccupied classroom was conducted over two weekends. Results During the lessons average PM-10 levels ranged from 40 to 170 µg/m3 and PM-2.5 levels ranged from 10 to 60 µg/m3. BS remained below 5 10-5m-1. These IAQ parameters were reduced by 30-50 % in the classroom with interventions relative to the reference classroom. In an unoccupied classroom these reductions were 60 to >90 %. Levels of VOC, NO2 and formaldehyde were low and showed much variation. Conclusions A field test of a low-dust carpet and a compact air filtration system in a classroom yielded a consistent reduction for particle-phase parameters. Much higher reductions were observed over the weekend, suggesting an interaction of occupancy with the effectiveness of the interventions. A contribution to the reduction of gas-phase IAQ parameters remained inconclusive.

Abstract Number	**O-1-11-02**
Presenter	Amanda Pappin, Amir Hakami*
Exposure	ambient air pollution
Health domains	costs
Type of research	health impact assessment

Assessing the Air Quality Health Benefits of Location-Specific Emission Controls: A Source Attribution Study using Adjoint Sensitivity Analysis

Background. Air quality management strategies that seek to maximize the benefits of emission control policies are best informed by source-specific air quality damage estimates. Adjoint sensitivity analysis is a tool that allows modellers to differentiate between emissions in different locations and their influences on air quality-related health effects and can thus guide emission reduction policies to preferentially target sources whose emissions are most influential on health. Aims. In this work, we aim to create a streamlined approach for comparing health benefits to costs of air pollution abatement using the source-specific information offered by adjoint sensitivity analysis. Methods. We use the adjoint of CMAQ to integrate epidemiological data with adjoint chemical transport modeling. We attribute national averted mortality in Canada and the U.S. (expressed in monetary terms as a “health benefit”) to location-specific emission reductions of NOx, VOCs and other species in North America. Results. Our past work on ozone and NO2-related mortality suggests significant spatial variability of health benefits related to emission reductions across North America. The largest Canadian health benefits come from emission reductions upwind of Toronto; reaching upwards of $250K/day and $50K/day (for 10% reductions in NOx and VOCs). For the U.S., we observe consistently higher-magnitude influences, and in some major urban areas we estimate negative influences (disbenefits) of controlling emissions (e.g., -$680K/day from New York for NOx) whose interpretation requires consideration for long-term air quality planning. As a continuation of past work, we conduct a multi-pollutant analysis and investigate the temporal component of health benefit influences related to emission controls in various locations. Conclusions. The source specificity of adjoint heath benefit influences offers valuable information for selective targeting of emissions for strategic air quality management.

Abstract Number	**O-1-11-03**
Presenter	Colin Lee*, Randall V. Martin, Daven Henze, Richard T. Burnett, Aaron J. Cohen, Aaron van Donkelaar, Christopher Murray, Rafael Lozano, Haidong Wang
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Sensitivity of Global PM2.5-related Premature Mortality To Local Emissions

Background: Recently, the Global Burden of Disease (GBD) Project has shown that exposure to ambient particulate matter with a diameter smaller than 2.5µm (PM2.5) contributes to over 5% of global premature deaths. PM2.5 has a variety of primary and secondary sources, including anthropogenic sources from fossil-fuel and biomass combustion. Because of the complex, non-linear relationship between emission and exposure, the sensitivity of ambient PM2.5 concentrations to changes in emissions is often difficult to calculate. Recently, an adjoint model has been developed for the GEOS-Chem global chemical-transport model. Adjoint modeling allows for efficient computation of sensitivities of model output to model input conditions such as emissions. Aims: To use adjoint modelling to quantify the effects of changes in local PM2.5 precursor emissions on global PM2.5-related premature mortality. Methods: The sensitivity of global premature mortality to local precursor emissions within 21 GBD regions was calculated using the adjoint of GEOS-Chem. Premature mortality was calculated using a new exposure-response function developed for the GBD project. Exposure to PM2.5 was based on a 6-year, satellite-derived dataset. Results: Total global premature mortality showed highest sensitivity to anthropogenic sulphur dioxide, nitrogen oxides and ammonia emissions in GBD region East Asia and to sulphur dioxide emissions in South Asia. Although populations are similar in these two regions, sensitivities to nitrogen oxides and ammonia emissions was an order of magnitude smaller in South Asia than in East Asia. Conclusions: Significant variability in the impact on human-health of PM2.5 precursor emissions was identified and quantified at scales commensurate with actionable policy.

Abstract Number	**O-1-11-04**
Presenter	Seulkee Heo*, Kyong-Whan Moon, Jong-Tae Lee
Exposure	others
Health domains	other
Type of research	cross-sectional study

Assessment of Environmental Health problems in Korea Using Integrated Environmental Health Indicators

Background: Considerable effort had been devoted to utilization of Environmental Health indicators when taking an action for environmental health problems. Aims: We investigated the usefulness of environmental health indicators for evaluation of environmental health situation in Republic of Korea. We also assess the association between environmental contamination and health outcomes by integrating indicators into a composite measure. Methods: We selected health-related environmental indicators and the environmental-related health status Indicators and obtained the data from published statistical data. The data covered years 2008-2009. Both the synthesized measures of environmental indicators and health status indicators were calculated using Strahll's taxonometric methods. The range of synthesized measures is within 0-1. The higher the value is, the better situation is in the given area. Results: The study areas consisted of all 16 large administrative areas in Republic of Korea. The arithmetic mean of the synthesized measure of environmental indicators was 0.348 (SD=0.151) and that of the synthesized measure of health status indicators was 0.708 (SD=0.107). Correlation coefficient between the synthesized measure of environmental indicators and health status indicators was 0.69 (95% CI, 0.28-0.88). Conclusions: Comparison between local communities based on integrated indicators may provide useful information for decision-makers to identify priorities in pollutant mitigation policies or in improvement actions for public health. Integrated indicators are also useful to describe the relationship between environmental contamination and health effects.

Abstract Number	**O-1-11-05**
Presenter	Giehae Choi*
Exposure	others
Health domains	other
Type of research	cross-sectional study

A study of the relationship between socioeconomic status and synthetic environmental indices

Background: Many studies on environmental inequities have proved unequal distribution of environmental pollution, but results remain inconclusive. Aims: The present study analyzed the relationship between socioeconomic status and overall air pollution status in Korea. Methods: Concentrations of NO2, CO, SO2, PM10 and O3 in the air were aggregated into overall air pollution status. Socioeconomic status indices include individual's data on income, education, number of household members, job, National Basic Livelihood Act recipients and neighborhood index. Neighborhood index of each district was calculated by standardizing and aggregating the district level data of number of families receiving National Basic Livelihood Act, proportion of people engaged in elementary occupation, population density and number of service industries. Regression analysis was conducted while adjusting for the effects of sex, smoking status, age and location. Results: People who graduated elementary school (ß=-0.18, p=0.02), middle school (ß=-0.20, p=0.01) and high school (ß=-0.39, p<0.00) live in more air-polluted districts compared to people with the education of college and higher. However, people with no education live in less air-polluted districts compared to people with education of college and higher (ß=0.73, p<0.00). People engaged in agriculture and fisheries live in districts with less air pollution compared to people engaged in administration (ß=-4.43, p<0.00), office jobs (ß=-4.06, p<0.00), sales service (ß=-3.77, p<0.00), elementary occupation (ß=-4.35, p<0.00) and others (ß=-4.06, p<0.00). People who earn less (ß=-4.35, p<0.00), are with lower neighborhood index (ß=-0.04, p<0.00), live with many household members (ß=-0.18, p<0.00) live in districts with more air pollution. However, National Basic Livelihood Act recipients (ß=0.38, p=0.00) tend to live in districts with less air pollution. Conclusions: This study gives strength to the idea that environmental discrimination exists among different socioeconomic groups.

Abstract Number	**O-1-11-06**
Presenter	Colin Soskolne*
Exposure	biomarker
Health domains	ethics
Type of research	review

Ethical dimensions of linking science and policy through impact assessment (e*)

Health impact assessment (HIA) is relied on for generating evidence to inform action and policy. It began in the 1960s as a 5-step, linear, stepwise approach, requiring first a hazard assessment; second, a vulnerability assessment; third, a health risk assessment; fourth, a risk management plan; and finally (fifth), a risk communication plan. The third step is the evidentiary base that draws on epidemiological methods for assessing health risk. More recently, the method has expanded to recognize that linearity has little relevance in the real world of complex mixtures of likely interacting hazards. With special reference to biomarkers of exposure and effects, these are preferred markers because they relate to biomarkers representing early biological changes and the early detection of exposure at a target site/organ. The underlying principle is that early detection has the best chance of leading to a successful outcome (i.e., doing good) for the individual. With many possible points of intervention, both at the individual and policy levels, the ethical considerations are numerous. Epidemiology, being an applied science, is a soft science that requires not only a science dimension, but art in conducting and interpreting health risk assessments. The potential for inadvertent and deliberate bias in both the design and interpretation of such evaluations, given their social context, must be considered in their planning and management. From considerations about the linearity of effects in a complex mixture to questions of privacy and legal protections, even where prior, written informed consent is obtained, are important in contexts where the clinical meaning of test results are not fully understood, and where these could have ramifications for employment and insurance. Also, concern about induced anxieties, not only for the person tested, but also for genetically linked family members, needs to be recognized. Through this presentation, delegates will be able to identify and discuss pertinent ethical dimensions in the session's presented papers.

Abstract Number	**O-1-12-01**
Presenter	Gilmar Sidnei Erzinger*, Donat Peter Häder, Peter Richter, Suellen Carolina Souza, Stephanie Wohllebe
Exposure	water
Health domains	parasitic disease
Type of research	case-control study

New Perspectives for the Control Of Mosquito Larvae Using Chlorophyll Derivates As Photosensitizers

Parasitic diseases such as malaria, dengue are a plague for millions of people mainly in underdeveloped and developing countries and often prohibit the economic development of the affected areas. Recently, it was demonstrated that mosquito larvae can be killed by means of photodynamic processes after the larvae have incorporated the photosensitizer chlorophyllin or pheophorbid, and were treated with light. These substances were produced from natural chlorophyll extracted from green plant material. By simple chemical modifications hydrophobic chlorophyll can be transformed to water soluble chlorophyllin, which in turn can be modified to pheophorbid by means of acidification. Due to their water solubility these substances can be applied in aquatic environments. Mosquito larvae and other larvae from biting insects in the water accumulate these substances mainly in their intestine. Upon illumination photodynamic reactions start leading to apoptosis and necrosis of the cells in the gut resulting in the death of the larvae. The mosquito larvae control was taken as Chaoborus sp. a dark incubation of about 3 h is sufficient to yield mortality of about 90% and ≥6 h resulted in almost 100% mortality during subsequent illumination. Temperature did not influence mortality of the larvae significantly in a treatment of 6 dark incubation and subsequent 3 h illumination. The concentration The LD50 value of chlorophyllin was 22,25µg mL-1. Culex sp is a genus of mosquitoes, and is important in that several species serve as vectors of important diseases, such as West Nile virus, filariasis, Japanese encephalitis was LD50 value 6.88µg mL-1. Aedes sp transmit serious diseases, including dengue fever and yellow fever was LD50 value 2.34µg mL-1. Anopheles sp transmit human malaria was LD50 value 5.88 µg mL-1. Chlorophyll derivatives demonstrate potential to be a substance with low cost and very interesting for production and pest control.

Abstract Number	**O-1-12-02**
Presenter	Ibrahima Sy*, Doulo Traoré, Michael Epprecht, Moussa Keita, Jürg Utzinger, Peter Odermat, Baidy Lô, Bassirou Bonfoh, Guéladio Cissé, Marcel Tanner
Exposure	water
Health domains	diseases of the digestive system
Type of research	health impact assessment

Mapping and predicting waterborne diseases in Nouakchott (Mauritania): improving public health interventions by using integrated geospatial models

Abstract: Waterborne diseases are a major issue of public health particularly in precarious areas in sahelian cities like Nouakchott (Mauritania) lacking of safe drinking water and adequate sanitation facilities. However, access to efficient and appropriate tools for managing this kind of health risks appears a crucial step due to the lack of useful disaggregated information at high spatial resolution. The purpose is to deepen the understanding of water and sanitation impact on waterborne diseases by using an integrated approach combining socio-environmental and epidemiological data from urban and geographical surveys realized in April 2012 covering 5.103 households geo-referenced by GPS. An overlay geospatial technique was applied to determine the environmental factors that govern diarrheal transmission. Geo-statistical and cartographic analysis show the increasing complexity of health risks disparities with an average of diarrheal morbidity at 25% varying from 10% to 40% according to neighborhoods and municipalities. High prevalence's of diarrhoea is most important in densest urban areas concentring together the largest part of unimproved water sources (exceeding 60%) and sanitation facilities (greater 30%) illustrating that environmental factors are the major driver of this disease transmission. Hence, by integrating environmental and epidemiological variables with geo-statistical and cartographic model, we conclude that the distribution of health risks due to diarrhoeal diseases is mainly related to sources of water supply and sanitation facilitiesin order to improve health interventions regarding socio-sanitary services by proposing appropriate and efficient tools to decision makers for reinforcing the level of performance of urban health development planning. Keywords: Waterborne diseases, diarrhoea, geo-spatial model, public health, Nouakchott, Mauritania.

Abstract Number	**O-1-12-03**
Presenter	Amit Masih*, Jitendra Lal
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	exposure measurement

Concentration and exposure profiles of polycyclic aromatic hydrocarbons (PAHs) in groundwater of commercial site at a terai belt of India

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of chemicals which belong to the group of persistent organic pollutants (POPs) know for there chemical carcinogenicity. They are released into the environment from anthropogenic sources such as combustion of fossil fuels, refused burning; industrial process and motor vehicle exhaust which results in occurrence of PAH in many parts of environment. The concentrations of groundwater PAHs were measured at commercial site of Gorakhpurduring winters. The samples were extracted with hexane by ultrasonic agitation. The extracts were then fractioned on a silica-gel column and the aromatic fraction was subjected to high pressure liquid chromatography for analysis of 16 priority PAH pollutants specified by environment protection agency (EPA). Mean concentrations of PAHs were found to be 23.21 ng/L. 3-ring, 4-ring and 5-ring PAHs were found to be dominant in the groundwater of Gorakhpurcity having 41%, 19% and 19% of the T-PAH. Univariate Pearson correlation analysis was performed which shows that the sources of all the PAH compounds are somewhat correlated with each other. Use of toxic equivalent factor (TEFs) shows that Ind(123-cd)P contributed the highest carcinogenic exposure equivalent (3.15 ng/L). The levels of PAHs in the groundwater can help in environmental risk assessment of this area.

Abstract Number	**O-1-12-04**
Presenter	Susan M. Pinney*, Frank M. Biro, Gayle Windham, Robert L. Herrick, Antonia M. Calafat, Paul Succop, Kayoko Kato, Lawrence H Kushi, Robert Bornschein
Exposure	water
Health domains	reproductive outcomes
Type of research	cohort study

Serum Concentrations of Polyfluoroalkyl Compounds in Young Girls and Duration of Being Breast Fed

BACKGROUND: Polyfluoroalkyl compounds (PFCs) have been detected in human breast milk which is a major exposure source for lactating infants. The objective of this study was to determine if being breast fed was related to PFC serum concentrations in young girls. METHODS: Through the NIH Breast Cancer and the Environment Research Program (BCERP), we conducted a study of PFC biomarkers in serum of 6-8 year-old girls in Greater Cincinnati (GC) (N=353) and the San Francisco Bay Area (SFBA) (N=351), collected in 2005-2009. Mothers self-reported the duration of breast feeding their daughters. RESULTS: We detected five PFCs in >95% of the girls. Median serum concentrations of both perfluorohexanesulfonate (PFHxS) and perfluorooctanoate (PFOA) were higher in the GC girls than in the SFBA girls (PFHxS 5.2 vs. 2.3 ng/ml, $p<0.001$; PFOA 7.3 vs. 5.8 ng/ml, $p<0.001$) but were similar for other PFCs. In linear regression analyses, with race, education, body mass index, parity and age at sample date as covariates, being breast fed was associated positively with PFC serum concentration in both GC and the SFBA ($p<0.01$). Duration of breastfeeding also was significantly associated with higher PFOA concentration in girls from both sites, with a significant test for linear trend of β estimates over the increasing duration categories (1-3, 4-6, 7-9, 10-12 and 13+ months) (SGBA $p=0.03$; GC $p<0.0001$). In GC, all breast feeding duration groups had p values ≤0.03, and the longest duration category of 13+ months having a p of <0.0001. In analyses of the other PFCs with the same terms in the models, we found evidence for an association of breast feeding with higher serum concentrations of PFHxS, 2-(N-methyl-perfluorooctane sulfonamide) acetate, and perfluorooctane sulfonate in GC girls only. CONCLUSIONS: Exposure to PFCs through breast milk is associated with higher serum concentrations in childhood.

Abstract Number	**O-1-12-05**
Presenter	Mu-Jean Chen*, Chao-Yu Guo, Kuo-Chang Hung, Huey-Jen Su
Exposure	water
Health domains	infectious diseases
Type of research	case-crossover study

Does Precipitation or Flood Trigger Leptospirosis Outbreak? A Case-Crossover study in Taiwan, 2007-2011

Background: As global climate disruption is predicted to increase the likelihood of extreme precipitation, determining how precipitation will affect the infectious disease has become a public health priority. Leptospirosis (LEPT) is a water-related infection mostly resulting from exposure through contaminated water of infected animal's urine. Only few case reports have indicated the LEPT may be at peak level during the rainy season or flood period at specific areas. Aims: Study aims to explore what effect precipitation or flood may impact on LEPT outbreak in Taiwan, across the entire nation. Methods: A database integrating daily average temperature, relative humidity, wind speed, accumulated precipitation and flood record, along with the LEPT outbreaks registry in Taiwan was analyzed for the period from 2007-2011. A time-stratified case-crossover design was applied to explore the association between weather factors and LEPT outbreaks. Each case and 2 self-control were matched by day of week. The effect of weather variability was investigated at lag 0 to 20 in each conditional logistic regression model, including the incubation period of LEPT. The estimated hazard ratios (HRs) were stratified by city, gender, occupation and age. Results: For LEPT, only daily precipitation and flood show significant associations if model adjusted for other weather factors. An increase in 5 mm precipitation at lag 13 is associated with a 3.4% (95% CIs: 1.01-1.06, p-value=0.006) increase in the LEPT outbreak. If there be a flood event occurring 12-13 days prior, it may raise the risk of LEPT outbreak at 2.65-fold (95% CIs: 1.14-6.32, p-value=0.012) and 5.59-fold (95% CIs: 1.23-28.07, p-value=0.026) for all population and skilled agricultural, forestry, livestock and fishery (MG6) workers respectively. Conclusions: Residence in heavier precipitation and flood areas may be at high risk of LEPT outbreak, especially higher for MG6 workers. The LEPT related interventions should warrant high priority in public health programs in light of the future climatic scenarios.

Abstract Number	**O-1-12-06**
Presenter	Okolie Ugochukwu*
Exposure	food
Health domains	ethics
Type of research	review

DAM CONSTRUCTIONS AND IRRIGATION PROJECTS FOR FOOD PRODUCTION IN NIGERIA: THEIR PUBLIC HEALTH AND ENVIRONMENTAL CONSEQUENCES (e*)

One of the basic needs of man is food. This has informed the efforts of governments, the world over, for sustained food production. In Nigeria, the desire/struggle for survival and the scarcity of food commodities have compelled the intensified efforts being made for self sufficiency in food production, through the establishment of irrigation schemes and construction of dams. These measures have health problems or environmental consequences in the region. This chapter presents a review of study that assessed the public health and environmental consequences of irrigation projects and dam constructions for food production in Nigeria. The study systematically reviewed the literatures spanning the past 20 years by linking public and environmental health challenges such as water borne diseases, water-related vector-borne diseases prevalence and incidence in relation to major water projects, with an emphasis on irrigation and dam constructions. The environmental challenges as a result of dam constructions were discussed and recommendations in form of suggestions on how to ameliorate the situations as part of an over- all environmental management package for the entire Nigerians were made.

Abstract Number	**O-1-14-01**
Presenter	Nicole Janssen*, Aileen Yang, Maciej Strak, Maaike Steenhof, Bryan Hellack, Thomas A. J. Kuhlbusch, Frank Kelly, Roy Harrison, Gerard Hoek, Flemming Cassee
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Oxidative potential of particulate matter collected at sites that differ in local emission sources

Background: The capacity of particulate matter (PM) to oxidise target molecules, defined as its oxidative potential (OP), has been proposed as a biologically more relevant metric than PM mass . Different assays exist for measuring OP and little is known about how different PM characteristics or sources contribute to the different measures of OP. Aim: To assess the OP of PM collected at sites with different local emission sources and to study the correlation with chemical composition for different measurement methods for OP. Methods: Within the framework of the RAPTES study (Risks of Airborne Particles-a Toxicological Epidemiological hybrid Study) PM2.5 and PM10 was sampled at 5 different sites: an underground train station, an animal farm, 2 different traffic sites and an urban background site in the Netherlands. Three a-cellular assays; dithiothreitol (OPDTT), electron spin resonance (OPESR) of hydroxyl radical generation, and ascorbate acid depletion (OPAA) were used to characterise the OP of PM. Results: By far the highest OP was observed at the underground, where OP of PM10 was 30 (OPDTT),) to over 600 (OPESR) times higher compared to the urban background location. For the outdoor sites, samples from the farm showed significantly higher OPDTT compared to the urban background and significantly lower OPESR and OPAA. Samples from the continuous traffic site showed significantly higher OP compared to the urban background for all assays. Contrasts in OP between sites were generally larger than for PM mass and NO2, but similar to contrasts observed for EC and traffic-related metals (e.g. Cu, Fe, Sb). OPDTT was highly correlated with PM mass (R 0.75-0.86), whereas OPESR and OPAA were highly correlated with EC, Cu, Fe, Sb and Mn (R 0.47-0.80). Conclusions: The OP of PM was highly elevated at an underground train station compared to outdoor locations. For the outdoor locations, the highest OP was observed along a highway with continuous traffic. Contrasts between sites as well as correlations with chemical characteristics depended on the specific OP assay used.

Abstract Number	**O-1-14-02**
Presenter	Morteza Khafaie*, Sundeep S. Salvi, Ajay Ojha, Behzad Khafaie, Sharad S. Gore, Chittaranjan S. Yajnik
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Outdoor Air Pollution and Systemic Inflammation (C-reactive protein) in Diabetes patients

Background: Exposure to ambient air pollution elicits systemic inflammatory responses. Subjects with type 2 diabetes are thought to be more vulnerable to such influences. Aim: To study the association between ambient air pollutants and serum C-reactive protein (CRP) concentration in 1392 Type 2 diabetes patients in Pune, India. Methods: Cross-sectional study linking daily time series ambient air pollution data (obtained from central monitoring sites) and plasma CRP from Wellcome Trust Genetic (WellGen) study, recruited between March 2005 and May 2007. Air pollution effects on CRP concentration were investigated with delays (lags) of 0 to 7 days and multi-day averaging span of 7, 14, and 30 days before blood collection adjusted to age, gender, BMI, hemoglobin, fasting plasma glucose, treatment with agents with anti-inflammatory action, season, air temperature and relative humidity. Results: Median CRP concentration was 3.49 mg/L. For one standard deviation (SD) increase in SO2 and NOx concentrations in ambient air, a day before blood collection (lag1), we observed a significant increase in CRP of 9.34% and 7.77% respectively. The effect was higher with lag2, 12.42% for SO2 and 11.60% for NOx and wore off progressively thereafter. We also found significant association with multi-days averaging times of up to 30 and 7 days for SO2 and NOx respectively. No significant associations were found between PM10 and CRP concentration except in summer. The association was significantly higher among patients with shorter duration of diabetes, and in those not on statin and thiazolidinediones (TZD) treatment. Conclusions: We demonstrate for the first time a possible contribution of ambient air pollution to systemic inflammation in Indian type 2 diabetes patients. This may have implications for vascular complications of diabetes.

Abstract Number	**O-1-14-03**
Presenter	Guillaume Poulhet*, Sébastien Dusanter, Sabine Crunaire, Philippe Karpe, Yves Bigay, Pascal Kaluzny, Nadine Locoge, Patrice Coddeville
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Measurements of formaldehyde emissions in indoor environments using a colorimetric Passive Flux Sampler

Formaldehyde (HCHO) is one of the most abundant volatile organic compounds in indoor environments. This pollutant exhibits concentrations that are several times higher than outdoor, rising questions about potential health effects from indoor exposure. Since building and furnishing materials are known to be important sources of formaldehyde, an efficient reduction of indoor concentrations could be achieved by replacing these emitters with less emissive materials. However, measurement techniques available to monitor in-situ emissions are either too cumbersome or require a delayed analysis in the laboratory, and therefore it is not an easy task to quickly identify sources of emissions. There is a need for real-time and easy-to-use analytical tools to pinpoint the strongest sources in indoor environments. In this communication, we will describe a Passive Flux Sampler (PFS) that is suitable for in-situ and real-time measurements of formaldehyde emissions from building and furnishing materials. This PFS is made of a small exposition cell containing a nanoporous sol-gel matrix doped with Fluoral-P. When exposed for a few hours onto an emissive material, Fluoral-P selectively reacts with formaldehyde, resulting in a color change of the matrix. An appropriate detector is then used to measure the matrix optical density, which is converted into an emission rate. This PFS was calibrated using building materials whose formaldehyde emissions were measured using an emission test chamber under normalized conditions (ISO 16000-9). We will also present the first deployment of this PFS in indoor environments and its potential for a robust identification of formaldehyde emission sources.

Abstract Number	**O-1-14-04**
Presenter	Carmen Diva André*, Paulo Afonso André, Paulo Hilário Saldiva, Francisco Rocha, Julio Singer
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Reliability of reflectance measures in ozone passive filters

Measurements of optical reflectance in passive filters impregnated with indigo carmine may be transformed to ozone concentrations via a calibration curve and constitute a low cost alternative for environmental monitoring, mainly to estimate human exposition. Given the possibility of errors caused by exposition bias, it is common to consider sets of m filters exposed during a certain period to estimate the latent reflectance on n different occasions. Mixed models with occasions as random effects are useful to analyze data obtained under such setups. The intraclass correlation coefficient of the mean of the m measurements is an indicator of the reliability of the latent reflectance estimates. Our objective is to determine m in order to obtain a pre-specified reliability of the estimates, taking possible outliers into account. To illustrate the procedure, we consider an experiment conducted at the LPAE/FMUSP in São Paulo, where sets of m=3 filters were exposed during 7 days in n=9 different occasions. The results show that the reliability of the latent reflectance estimates for each occasion obtained under homoskedasticity is km=0.74. A residual analysis according to the proposal of Nobre and Singer (2007, Biometrical Journal) suggests two occasions with a different within-occasion variance. A refined model with two within-occasion variance components was considered, yielding km= 0.53 for these occasions and km=0.87 for the remaining ones. To guarantee that all estimates have a reliability of at least 0.80 we would require to obtain measurements on m=11 filters in each occasion.

Abstract Number	**O-1-14-05**
Presenter	Balducci Catia*, Romagnoli Paola, Perilli Mattia, Cecinato Angelo
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Illicit psychotropic substances in schools, houses and offices of Rome, Italy.

Illicit psychotropic substances in schools, houses and offices of Rome, Italy. Balducci C, Romagnoli P, Perilli M, Cecinato A National Research Council of Italy, Institute of Atmospheric Pollution Research (CNR-IIA), Rome, Italy Background.The occurrence of psychotropic substances (PSs) in the atmosphere is consolidated although misevaluated. Nonetheless, cocaine is quasi-ubiquitous and, when it is absent, traces of cannabinoids (CBs) are observed. Aim. Passive consumption of drug leads to clinical effects in heavily contaminated environments. Illicit PSs are often abused inside but a lack of information exists about their burdens indoors. In the frame of the EXPAH Life+ Project a set of in-field measurements were made in the Rome area both in indoor and outdoor air. This was the chance to carry on ancillary measurements, aimed at: i) drawing a more comprehensive knowledge of the drugs pollution picture indoors; ii) discriminating the PAH health impact from those of co-pollutants including illicit substances. Methods. Two monitoring campaigns were made in winter and spring-summer 2011-12. Three schools, one office and four houses were investigated. PSs were measured in parallel to PAHs; attention was paid to particulate fraction that, at except for nicotine, accounts for >95% of total. Procedures optimized at CNR-IIA were adopted for our study. Results. PSs affected similarly indoor and outdoors environments, suggesting the presence of indoor sources even when inhabitants were not (ab)users. Cocaine affected all sites investigated and its seasonal drop in summer was low compared to CBs and PAHs. Events of drug pollution were recorded indoors, suggesting the spotty abuse of drugs. Conclusions. PSs were observed indoors for the first time. The cocaine, caffeine and CB burdens were comparable to those outdoors and the behaviour observed elsewhere for nicotine was confirmed. Their time and space modulations do not fit with those of the concurrent contaminants.

Abstract Number	**O-1-14-06**
Presenter	Moniek Zuurbier*, Bernard Groot, Anouk Besselink, Lex Groenewold, Manon Vaal, Gerard Hoek, Nicole Janssen, Saskia van der Zee
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

The impact of diesel trains and inland ships on measured ultrafine particle and black carbon concentrations along railways and waterways

Background The impact of traffic diesel emissions on ultrafine particles and black carbon is well known. However the impact of other sources, such as inland ships and diesel trains is much less known. These sources may become more important when the contribution of traffic emissions will be significantly reduced by EEC regulations. Aims This study aims to measure the impact of diesel trains and inlands ships on ultrafine particle and black carbon concentrations near railways and waterways. Methods Particle Number Concentrations and Black Carbon were measured continuously in 1-second intervals with respectively a portable CPC meter and a portable Aethalometer. Measurements were conducted downwind on the shore or near railways in areas with low road traffic intensity. A field worker registered the time and type of passing ships and traffic. Ship emissions were measured at the Waal near Nijmegen and the Amsterdam-Rhine Canal near Utrecht. Diesel train emissions were measured near Arnhem and Zutphen. Mixed model analysis was used to analyse the association between short-term concentrations and passing trains or ships in the past two minutes, adjusted for passing road traffic. Results Inland ships and diesel trains contributed on average 500 to 1500 ultrafine particles/cm3 (5%) on the shore or near the railroad during the measuring period. Passing freight ships and diesel trains also increased Black carbon concentrations, but the trend was less consistent possibly related to low precision of the portable aethalometers at high time resolutions and low black carbon concentrations. Conclusions This study shows that diesel trains and inland ships impact the air quality near housing locations. The relative contribution of these sources will increase, when EEC regulations reduce traffic emissions. Policy makers have to take in account the local contributions of inland ships and diesel trains on ultrafine particles.

Abstract Number	**O-1-16-01**
Presenter	Patrizia Schifano*, Adele Lallo, Federica Asta, Manuela DeSario, Paola Michelozzi
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	cohort study

Effects of high and low temperature and air pollution on the risk of preterm births. A cohort study, Rome 2001-2010

Background Preterm births represent about 10% of total births and the first cause of perinatal mortality and morbidity in developed countries. Aims To evaluate the effect of short term exposure to high and low temperatures and air pollution on preterm delivery. Moreover to identify maternal risk factors enhancing individual susceptibility. Methods All singleton live-births in Rome between 2001-2010 were analyzed. Preterms were defined as births between the 22nd and the 36th week of gestational age. Cold (Nov to Mar) and warm (Apr to Oct) season were studied using daily minimum temperature (MT) in the first and maximum apparent temperature (MAT) and heat waves (HW) in the second. PM10, O3 and NO2 were also analyzed by season. Shape and lag dimension of the temperature-preterm relationship was tested. A Poisson GAM model was used for effect estimation, controlling for seasonal and long-term trends, day of the week, holidays. Socio-demographic and clinical risk factors were analyzed. Results Study population was of 132,691 total births, 5.5% of which preterm. A linear relationship with lag 0-2 was observed with MAT in summer, while no effect of MT was observed in winter at any lag. An increase of 1,7% (IC 95%: 0.67 -2.64) in daily preterm births per 1°C increase in MAT was estimated. Older women, with higher education level and those with obstetric or chronic pathologies reported during delivery had a lower risk while women with a chronic disease in the two years before delivery and mothers <20yrs showed a higher risk (%change 7.09; IC95% 1.42-13.08; and 2.99; IC95% 0.11-5.95 respectively). We observed a 17% increase in preterm births during HW days. Air pollutants showed no effect on preterm births, and didn't act as confounders and effect modifiers of temperature-preterm relationship. Conclusion Prevention measures targeted to pregnant women during high temperatures should be introduced, to reduce the risk of preterm birth and the consequent adverse health conditions among preterm children.

Abstract Number	**O-1-16-02**
Presenter	Payam Dadvand*, Bart Ostro, Francesc Figueras, Maria Foraster, Xavier Basagaña, David Martínez, Rob Beelen, Marta Cirach, Gerard Hoek, Bert Brunekreef, Mark J Nieuwenhuijsen
Exposure	others
Health domains	reproductive outcomes
Type of research	case-control study

Mediator Role of Air Pollution, Heat, and Noise on the Association Between Maternal Residential Proximity to Major Roads and Term Low Birth Weight

BACKGROUND: Maternal residential proximity to major roads has been associated to a range of adverse pregnancy outcomes; however, there is no available study investigating mediators of such an association. AIMS: To investigate the association between term low birth weight (LBW) and maternal residential proximity (200m) to major roads and to explore mediating roles of air pollution (PM2.5, PM2.5-10, PM10, PM2.5 absorbance, NO2, NOx), heat, and noise in this association. METHODS: This study was based on 6,487 singleton term births occurred in Barcelona (2001-2005). We assessed individual exposures to air pollution, noise, and heat using respectively temporally-adjusted land use regression models, average of environmental noise levels across 50m and 250m buffers based on the European Noise Directive strategic noise map, and average of satellite-derived land surface temperature in 50m buffer around each residential address. The association between term LBW and proximity to major roads and mediator, we used logistic regressions, adjusted for relevant covariates. We assessed the mediating role of air pollution, heat, and noise exposures by quantifying the change in the OR for the proximity to major roads after including the mediators (one at a time) alongside the indicator of the proximity to major roads in fully-adjusted models. RESULTS: Proximity to major roads and an interquartile-range increase in heat exposure and the third trimester exposure to PM2.5, PM2.5-10, and PM10 were associated with respectively 46%, 22%, 24%, 25%, and 26% increase in term LBW risk. 19.7% and 11.8% of our observed association between residential proximity to major roads and term LBW could be explained byair pollution (PM2.5) and heat exposures respectively. Air pollution (PM2.5) and heat together could explain about one-third of this association. CONCLUSION: Our observed increased risk of term LBW associated with proximity to major roads was partly mediated by air pollution and heat exposures.

Abstract Number	**O-1-16-03**
Presenter	Maribel Casas*, Sylvaine Cordier, David Martínez, Nathalie Costet, Joelle Fevotte, Manolis Kogevinas, Mark J Nieuwenhuijsen, Martine Vrijheid
Exposure	others
Health domains	reproductive outcomes
Type of research	meta-analysis

Adverse birth outcomes associated with selected maternal occupations in 12 European birth cohorts – a CHICOS initiative

Background:Occupational maternal exposures during pregnancy may affect fetal development. The population-based birth cohort design has been used very few times in this field; however, they collect data prospectively and self-reported by the mother, and can follow children up for many years. Aims: To examine the association between selected maternal occupations and adverse birth outcomes and evaluate the heterogeneity between cohorts. Methods: As part of the CHICOS project (www.chicosproject.eu), a total of 12 European birth cohorts studying more than 200,000 mother-child pairs were included. Nine occupational sectors were defined as being exposed to a range of specific environmental agents: health, day-care, cleaning, agriculture, electricity, laboratory work, food industry, printing and painting, and hairdressers. The reference group was defined as being non-exposed to environmental agents including managers, computer workers, and office clerks. Adverse birth outcomes assessed were: birth weight, small-for-gestational-age, term low birth weight, gestational age, and preterm birth. We performed meta-analyses using a random effects model and explored heterogeneity. Results: Between 74-97% of women worked during pregnancy. The nine selected occupational sectors accounted for 58% of the total workforce. Women working in the health sector had infants with lower risk of being SGA (adj OR=0.93; 95%CI=0.88, 0.99) whereas construction workers had babies with higher risk (OR=1.31; 95%CI=1.00-1.70). Work in food industry and agriculture increased the risk of preterm (OR=1.53, 95%CI=1.13, 2.08) and term low birth weight babies (OR=2.03; 95%CI=1.09, 3.79), respectively. There was little evidence for heterogeneity between cohorts in these analyses (I2<25%). Conclusions: Work during the pregnancy in certain occupational sectors may adversely affect birth outcomes across Europe. Further analyses based on this dataset will apply job exposure matrices and study health effects in children later in life.

Abstract Number	**O-1-16-04**
Presenter	Adeleh Shirangi*, Carol Bower, D'Arcy Holman, David Preen, Neville Bruce
Exposure	others
Health domains	reproductive outcomes
Type of research	cohort study

Handling Toxic Drugs Associated with the Risk of Birth Defects in Offspring of female veterinarians

Background-Many cytotoxic drugs have been reported to be carcinogens, mutagens or teratogens. This study examined the association of maternal occupational exposure to handling toxic drugs and pregnancy intention status with risk of birth defects among a cohort of female veterinarians. Methods-Data on health and exposure during each pregnancy were obtained by self-administered mailed questionnaire from 321 female participants (633 pregnancies) in a follow up survey of the Health Risks of Australian Veterinarian (HRAV) project. Eligible participants were graduates ofAustralian veterinary schools during the 45-year period 1960-2000; 77% of respondents graduated after 1980. The Generalised Estimation Model by Poisson Regression with robust error variance was used to calculate crude and adjusted relative risk (IRR) in a multiple regression procedure to compare those exposed to cytotoxic drugs with thosee unexposed in a homogenous group of women worked in clinical veterinary practice. Results-Female veterinarians handling toxic drugs during their pregnancy had a two-fold increased risk of birth defects in their offspring (IRR=2.03, 95%CI (1.03-4.08). There was also a significant increased risk of birth defects in offspring of those women who didn't have planned pregnancy and those women who took 4 to 12 months or more than to become pregnant. The results were consistent in subgroup analysis of more recent graduates (after 1980) and in those working specifically in small animal practice. Conclusion-The results of this study, combined with existing data on animals and humans and with results found from previous surveys on other health care workers, suggest that the adverse effect of handling toxic drugs may include an increased risk of birth defects.

Abstract Number	**O-1-16-05**
Presenter	Joëlle Le Moal, Matthieu Rolland, Vérène Wagner, Dominique Royère, Jacques De Mouzon, Annabel Rigou*
Exposure	others
Health domains	reproductive outcomes
Type of research	others

Decline of sperm quality in France between 1989 and 2005

Background Growing biological, toxicological, experimental and human data support the endocrine disruptors' (ED) hypothesis assuming that fetal exposure could impair reproductive outcomes, of which sperm quality. However decrease in human sperm quality has been debated for a long time, due to spatial heterogeneity in the observed trends and methodological issues, including selection bias. Aims Analyze the temporal trends of sperm quality for the whole of France, in the general population. Methods Data were provided by the Fivnat register, which monitored ART attempts in France from 1989 to 2005. We selected 26 609 male partners of women who had both tubes either absent or blocked, which we argue is the sample closest to general population. Temporal trends for each indicator of semen quality were modeled using generalized additive models adjusted for season and age. Sensitivity analyses included the reiteration of the analysis on data from a second spermiogram available for each man, and on another subsample of men diagnosed as fertile. Results There was a significant and continuous decrease in sperm concentration of 32.2% [95 % confidence interval : 26.3–36.3] during the study period. A significant, but not quantifiable, decrease in the percentage of sperm with morphologically normal forms over the 17-year period was also observed. There was no consistent trend for motility. Conclusions To our knowledge, it is the first study concluding to a severe and general decrease in sperm concentration and morphology at the scale of a whole country over a substantial period. This constitutes a serious public health warning and the link with ED particularly needs to be addressed.

Abstract Number	**O-1-16-06**
Presenter	Kelly K. Ferguson*, Thomas McElrath, John D. Meeker
Exposure	others
Health domains	reproductive outcomes
Type of research	case-control study

Environmental phthalate exposure is associated with increased odds of preterm birth

Background: Preterm birth is a leading cause of neonatal mortality with a variety of associated risk factors. Environmental exposures represent an important but understudied set of potential contributors. Phthalate diesters are used extensively in a variety of consumer products worldwide. Consequently, exposure in pregnant women is highly prevalent. In this study we investigate the relationship between phthalate exposure during pregnancy and preterm birth. Methods: From 2006-2008 women planning to deliver at the Brigham and Women's Hospital in Boston were prospectively enrolled in an observational cohort study. Each provided demographic data, samples, and information about birth outcomes. Within this group we selected 132 cases of preterm birth and 350 randomly assigned controls, and analyzed urine samples from three time points during pregnancy for levels of phthalate metabolites. We hypothesized there is a relationship between phthalate exposure and preterm birth. Results: Geometric means of the di-2-ethylhexyl phthalate (DEHP) metabolites mono-(2-ethyl)-hexyl phthalate (MEHP) and mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP), as well as mono-n-butyl phthalate (MBP) and mono-(3-carboxypropyl) phthalate (MCPP) were significantly higher in cases compared to controls. In adjusted models, MEHP, MECPP, and ∑DEHP metabolites were associated with significantly increased odds of preterm birth. When spontaneous preterm births were examined alone, MEHP, mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP), MECPP, ∑DEHP, MBP, and MCPP metabolite levels were all associated with significantly elevated odds of delivery. Conclusions: These results are consistent with evidence from toxicological and exploratory human studies and support a relationship between phthalate exposure and increased risk of preterm birth. As phthalate exposure can be avoided, steps should be taken to decrease maternal exposure to phthalates during pregnancy.

Abstract Number	**O-1-17-01**
Presenter	Esther Garcia-Esquinas*, Marina Pollán, Jason G. Umans, Kevin A. Francesconi, Walter Goessler, Eliseo Guallar, Barbara V. Howard, Jeunliang Yeh, Lyle Best, Ana Navas-Acien
Exposure	arsenic
Health domains	cancer
Type of research	cohort study

Arsenic Exposure and Cancer Mortality in a US-based Prospective Cohort: the Strong Heart Study

Objective: To evaluate the prospective association between low to moderate arsenic exposure and all-cause and site-specific cancer mortality in American Indians from Arizona, Oklahoma and North and South Dakota who participated in the Strong Heart Study in 1989-91. Methods: Prospective cohort study of 3,347 American Indians 45 to 74 years of age followed through 2008. Baseline urine arsenic species (inorganic arsenic, monomethylarsonate (MMA), dimethylarsinate (DMA) and arsenobetatine and other arsenic cations) were measured using anion exchange high performance liquid chromatography with inductively coupled plasma mass spectrometry. Exposure to inorganic arsenic was estimated as the sum of inorganic and methylated arsenic species in urine. Cancer events were assessed by annual mortality surveillance reviews and recorded according to the International Classification of Diseases, 9th Revision. Results: Median (interquartile range) urine concentration for the sum of inorganic and methylated arsenic species was 9.7 (5.8-15.6) µg/g creatinine. After adjustment for smoking status and other potential confounders, the fully-adjusted hazard ratios (95% confidence intervals) comparing the 80th versus the 20th percentiles of arsenic were 1.14 (0.92-1.41) for overall cancer, 1.56 (1.02-2.39) for lung cancer, 1.34 (0.66, 2.72) for liver cancer, 3.30 (1.28-8.48) for prostate cancer, and 0.44 (0.14, 1.14) for kidney cancer. The corresponding hazard ratios were 2.46 (1.09-5.58) for pancreatic cancer, and 0.46 (0.22-0.96) for lymphatic and hematopoietic cancers. Arsenic was not associated with cancers of the esophagus and stomach, colon and rectum, and breast. Conclusions: Low to moderate exposure to inorganic arsenic was prospectively associated with increased mortality for cancers of the lung, prostate and pancreas. These findings support the role of low-moderate arsenic exposure in lung, prostate and pancreas cancer development.

Abstract Number	**O-1-17-02**
Presenter	Shen Heqing*, Weipan Xu, Jie Zhang, Yankai Xia
Exposure	arsenic
Health domains	reproductive outcomes
Type of research	case-control study

Urinary metabolic biomarkers link induced oxidative stress from general arsenic exposure to male infertility in a Han Chinese Population

Although animal studies have identified that high exposure levels of the more toxic arsenite (AsIII) can induce adverse effects on male semen quality, there is a lack of corresponding human exposure and epidemiological studies to support the hypothesis that general environmental arsenic exposure can impair male fertility. To address this, we designed a case-control study investigating possible correlations between the concentrations of different arsenic species in urine, urinary metabolic biomarkers, and infertility characterized by poor semen quality. Arsenate (AsiV) was associated with infertility in a concentration-dependent manner: in comparison with the 1st quartile, subjects with AsiV levels above the median were more likely to exhibit male idiopathic infertility with a 4.9-fold [95% confidence interval (CI), 1.8-13.6] and 13.6-fold [95% CI, 4.8-38.6] increase in risk for the 3rd and 4th quartiles, respectively. Dimethylarsinic acid (DMAV) and arsenobetaine (AsBV) levels were significantly higher among infertility cases compared to controls in the absence of any dosage trend. We also observed some biomarkers, which indicate abnormalities in testicular function and Leydig cell steroidogenesis (including impaired sperm metabolism and maturation, or anti-oxidation during spermatogenesis), were dose-dependently correlated with both male infertility and AsiV concentrations; the latter correlation was independent of disease. These included acylcarnitines, aspartic acid and hydroxyestrone, which were negatively associated with infertility; and, uridine and methylxanthine, which were positively associated. In conclusion, for the first time we show that elevated urinary concentrations of AsiV from general exposure are strongly associated with male infertility, and arsenic species may exert toxicity via oxidative stress and sexual hormone disrupting mechanisms as shown by related biomarkers.

Abstract Number	**O-1-17-03**
Presenter	Monica Sianez*, Raul U. Hernandez-Ramirez, Claudio Luz, Mariano E. Cebrian, Lizbeth Lopez-Carrillo
Exposure	arsenic
Health domains	obesity
Type of research	cross-sectional study

Arsenic methylation efficiency and anthropometric characteristics of Mexican women.

Background Arsenic methylation efficiency (AME) plays an important role in arsenic (As) toxicity. A low AME, characterized by higher proportion of monomethylarsonic acid (%MMA) in urine, has been associated with an increased risk of As-related diseases (bladder, lung and skin cancer, and skin lesions). AME may be influenced by environmental and individual susceptibility factors. Aim This study examined whether AME was associated with anthropometric characteristics in women from northern Mexico. Methods Participants (1030) were interviewed about sociodemographic and lifestyle characteristics. Anthropometric measurements included body mass (BMI) and body adiposity (BAI) indexes, waist-to-height (WHtR) and waist-to-hip ratios (WHR). Urinary As metabolites were measured using a HPLC-ICP-MS system. AME was assessed by estimating the relative urine levels of inorganic As (%IAs), %MMA, dimethylarsinic acid (%DMA), MMA/IAs and DMA/MMA. Associations were calculated by multiple linear regression analyses. Results Several anthropometric characteristics were significantly correlated with a decrease in %InAs (BAI>WHtR), %MMA (BMI>WHtR>BAI), and MMA/IAs (BMI>WHtR>BAI), and with an increase in %DMA (BAI>WHtR), DMA/MMA (BMI>WHtR>BAI) and DMA/IAs (BAI>WHtR). A BMI<25kg/m2 was associated with a 29% increase in the geometric mean of %MMA, an increase in MMA/IAs (20%) and a decrease in DMA/MMA (24%). These results remained significant after adjusting for age, total urinary As, smoking status, and urinary creatinine. Conclusions Leaner women showed lower AME than those with a higher BMI and may therefore be more susceptible to As toxicity, as previously suggested in studies elsewhere. Anthropometric parameters may contribute to identify high-risk subjects within chronically As exposed populations.

Abstract Number	**O-1-17-04**
Presenter	Dragana Jovanovic*, Katarina Paunovic, Zorica Rasic-Milutinovic, Branko Jakovljevic, Gordana Perunicic-Pekovic, Dragana Manojlovic, Biljana Dojcinovic
Exposure	arsenic
Health domains	cardiovascular disease
Type of research	cross-sectional study

ARSENIC IN DRINKING WATER AND PREVALENCE OF HYPERTENSION AMONG CASES OF TYPE 2 DIABETES - DATA FROM ZRENJANIN MUNICIPALITY, SERBIA

Background:Arsenic is constantly present in drinking-water supply systems of Zrenjanin municipality across decades. It presents a great public health problem in Serbia, but its relationship with the occurrence of hypertension among persons with type 2 diabetes mellitus (T2DM) has not been studied previously. Aims: The aims of this study is to assess the prevalence of hypertension among persons with type 2 diabetes in Zrenjanin municipality, consuming different levels of arsenic in drinking water, and to explore whether arsenic exposure increases risk for earlier onset of hypertension. Methods: This cross-sectional study included 281 cases of type 2 diabetes from Zrenjanin municipality, who were divided in two groups according to arsenic level in drinking water, based on current guidelines (10 µg/L). T2DM was diagnosed according to International Diabetes Federation (IDF) criteria, while hypertension was assessed according to the Seventh Joint National Criteria for Hypertension Classification (JNC7). Results: Prevalence of hypertension among persons with type 2 diabetes, who were exposed to drinking-water arsenic above 10 µg/L was 85.4%, and wassignificantly higher than the prevalence of hypertension among persons exposed to drinking-water arsenic below 10 µg/L (79.8%) ($p<0.05$). An earlier onset of hypertension was observed among diabetic patients exposed to drinking water arsenic above 10 µg/L (average age 52.26±11.21) than in petients consuming arsenic less than 10 µg/L (55.83±11.28) ($p<0.05$). Multivariate logistic regression analysis showed that age, obesity, waste-to-hip ratio and arsenic exposure above 10µg/L were significant risk factors for the development of hypertension in persons with T2DM. Conclusion: Arsenic exposure from drinking water, in concentrations above national standard, may increase the risk for the occurrence of hypertension and its earlier onset among persons with type 2 diabetes in Zrenjanin municipality.

Abstract Number	**O-1-17-05**
Presenter	Daniela D'Ippoliti, Enrica Santelli, Marina Davoli, Paola Michelozzi*
Exposure	arsenic
Health domains	other
Type of research	cohort study

Public health emergency due to arsenic in drinking water: long-term health effects among exposed populations in Central Italy

Background and aim: Arsenic (As) is a carcinogenic agent (IARC-Group 1)and in Italy naturally occurs in aquifers supplying drinking water. Several areas exceed the EC Drinking Water Directive limit (<10 µg/L), of which 60 municipalities in Viterbo Province, Central Italy. The Regional Health authority declared the state of emergency and asked for an epidemiological evaluation of the health effects in the exposed population. Methods: The study population is of 299.830 residents. As exposure was measured at municipality level, categorized for increasing concentrations: <10µg/L(reference), 10-20µg/L, >20µg/L. The outcomes were: mortality for cancers, cardiovascular and respiratory diseases and diabetes; incidence of AMI and bypass surgery; prevalence of COPD and diabetes; adverse pregnancy outcomes (preterm births, low birth weight, sex-ratio). Relative Risks (RR) by gender were estimated by Multilevel Models, adjusted for age, socioeconomic level, smoke and radon in the period 1990-2010. Results: 20% of residents were living in areas with As>20µg/L, with concentrations up to 80µg/L. Risks increased with increasing As, and in the highest class of As a significant increased risk was found for lung cancer(RR=1.25), bladder cancer(RR=1.21), ischemic heart disease(RR=1.17), COPD (RR=1.69), diabetes (RR=1.69) and incidence of bypass surgery(RR=1.41). No association was found for pregnancy outcomes but sex-ratio was altered with a higher proportion of males. A cohort approach is ongoing with lifetime exposure at individual level geocoding residential history; results will be presented after reporting to the regional authorities. Conclusions: As in drinking water represents a major public health problem in the population of Viterbo province. Considering the life-long burden of As in this population and that this problem has not been addressed yet, results might provide information useful for decision makers to start epidemiological surveillance and public health interventions

Abstract Number	**O-1-17-06**
Presenter	Chin-Chi Kuo, Virginia M. Weaver, Jeffrey J. Fadrowski, Eliseo Guallar, Ana Navas-Acien*
Exposure	arsenic
Health domains	cardiovascular disease
Type of research	cross-sectional study

Arsenic exposure and hyperuricemia in US adults

Background: Both serum uric acid level and arsenic exposure have been recognized as risk factors for cardiovascular and kidney diseases. However, the association between serum uric acid and arsenic exposures has not been evaluated in a population database. Aim: To investigate the association between arsenic exposure and serum uric acid levels in a representative sample of US adults. Methods: Cross-sectional study in 6845 adults aged 20 years or older who participated in the 2003-2010 National Health and Nutrition Examination Survey (NHANES) and had determinations of serum uric acid and urine total arsenic, dimethylarsinate (DMA), and arsenobetaine. Hyperuricemia was defined by serum uric acid level higher than 7.0 mg/dL in men and higher than 6.0 mg/dL in women. Results: In men, the ratio of geometric means of serum uric acid was 5% (95% CI 1.02-1.08), 3% (95% CI 1.00-1.06) and 5% (1.02-1.08) higher per interquartile range (IQR) of total arsenic, DMA and arsenobetaine, respectively, after adjustment for sociodemographic factors, lifestyle characteristics, and comorbidities related to purine metabolism. In men, the odds ratios for hyperuricemia among highest quartiles of urine total arsenic was 1.90 (95% CI, 1.23-2.94) and urine arsenobetaine 1.57 (95% CI, 1.12-2.20). Urine total arsenic increased the odd ratio of hyperuricemia by 46% per IQR increase (95% CI, 1.18-1.80), urine dimethylarsonic acid by 25% per IQR increase (95% CI, 1.06-1.47), and urine arsenobetaine by 45% (95% CI, 1.16-1.82). Exploratory interaction analyses showed significant effect modification by blood lead levels (p value for interaction=0.01) in men with arsenic exposure measured by dimethylarsinate. However, such interactions were not identified in women. Conclusion: Our data suggest that low level exposures of arsenic may increase the risk of hyperuricemia in men. Joint effect between low arsenic and lead exposures significantly increased the risk of hyperuricemia. Future research focusing on establishing the causal relationship between arsenic and serum uric acid are needed.

Abstract Number	**O-1-20-01**
Presenter	Benjamin Struchen*, Ilaria Liorni, Marta Parazzini, Stephanie Gängler, Paolo Ravazzani, Martin Röösli
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure measurement

Children's Exposure to Extremely Low Frequency Magnetic Fields: A personal exposure measurement study.

Background:There is concern regarding the possible health effects of exposure to sources of extremely low frequency magnetic fields (ELF MF) at the microtesla level, mainly as a possible risk factor for childhood leukaemia. However, no biological mechanism is known, to explain an association at such low levels and little is known about the real everyday exposure of children. Aims:Within the framework of the EU FP7 research project "Advanced Research on Interaction Mechanisms of electromagnetic exposures with Organisms for Risk Assessments" (ARIMMORA) our study aims to close a knowledge gap of levels and temporal patterns of exposure for European children. Methods:Three groups (n=50) of a total of 150 children (age: 5-13) in Italy and Switzerland are equipped with personal measurement devices (EMDEX II) and a GPS logger to record ELF MF exposure during their regular activity during 48 hours twice, in summer and winter. Furthermore a time-activity diary about the children's whereabouts is filled in and spot measurements in the children's bedrooms are conducted. Group I consists of children living or attending school within 200m of a high voltage power line; group II comprises children living in a building with a transformer substation and group III represents a control group composed of children sampled randomly. Exposure patterns derived from the measurements are analysed according to location and behavioural activity. Results:Preliminary results of the summer measurements from 40 Italian and 70 Swiss children show an overall median geometric mean exposure of 0.03µT with an interquartile range (IQR) of 0.02µT. A linear mixed model clustering for children of the same family reveals no significant differences according to group, country, age or urban setting. Median geometric mean of spot measurements in the bedroom was 0.03µT (IQR 0.03µT). Weighted kappa coefficient for exposure classification (<0.1µT, 0.1-0.3µT, >0.3µT) of personal and spot measurements was 0.344.

Abstract Number	**O-1-20-02**
Presenter	Zhenan Han*, Ailu Chen, Yaoxing Wu, Victor W.C. Chang
Exposure	organic compounds
Health domains	respiratory disease
Type of research	exposure measurement

Air quality and personal exposure in a middle-sized shipyard in Singapore

The shipbuilding industry plays a crucial part in Singapore's economic growth. Employing over 100,000 workers, it generates an annual turnover of close to $10 billion. However, occupational exposures to air pollutants, such as PM and VOCs, are rarely studied. To characterize major air pollutants in the shipyard and the associated personal exposure level, instantaneous personal samplings of PM2.5, PM10 and VOCs were carried out in a middle-sized shipyard in Singapore. Personal samplings were taken in several microenvironments where different activities were carried out. PM was monitored by the optical particulate counters with density correlated by the gravimetric measurements; while VOCs were sampled with sorbent tubes and analyzed by TD-GC/MS. The PM2.5 and PM10 concentrations in different microenvironments cover a wide range between 9.1-171.6, and 19.5-810.4µg/m3, respectively. The highest PM exposure was found inside a Hull shop where complex shipbuilding activities were conducted. The lowest PM exposure was found inside the administration building with air conditioning system. Totally 54 types of VOCs were detected. TVOC ranges from 32.3 to 36482.6µg/m3. BETX are the dominating VOCs with an average mass ratio of about 60%. Other major VOCs include 1,2-Dichloroethene, Dodecane, 1,2,4-Trimethylbenzene, and naphthalene etc. High VOCs exposure was found inside the dormitory without air conditioning. There are significant differences between indoor and outdoor VOC compositions. The highest instantaneous VOCs exposure was captured by the main road with high activity level and traffic density. In sum, both PM and VOCs exposures inside the shipyard area are relatively high during the work hours. Both PM and VOCs exposures might cause adverse health concerns based on the current study. Source control and personal protection equipment are also evaluated to reduce the exposure level for different microenvironments.

Abstract Number	**O-1-20-03**
Presenter	Denise Montagne*, Gerard Hoek, Mark J Nieuwenhuijsen, Timo Lanki, Meritxell Portella, Arto Pennanen, Tarja Yli-Tuomi, Marta Cirach Pradas, Marloes Eeftens, Bert Brunekreef
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Temporal associations of ambient concentrations of PM2.5 elemental composition with indoor and personal measurements

Background and aims The ambient concentrations of the components of PM2.5 vary temporally due to weather influences. Studies have documented that temporal variation of outdoor PM2.5 concentration is highly correlated with temporal variation of personal exposure. Very few papers have investigated the short term temporal correlation between outdoor and personal exposure for the elemental composition of PM2.5. The elements of interest were copper (Cu), Zinc (Zn), iron (Fe), potassium (K), nickel (Ni), vanadium (V), silicon (Si) and sulfur (S). Methods In Helsinki, Utrecht and Barcelona five participants from urban background, five from semi-urban background and five from busy street sites were selected (15 participants per city). Outdoor, indoor and personal PM2.5 samples were collected by the participants for two weeks in three different seasons (winter, summer and spring/autumn). A measuring period was 96 hours and measurements were conducted by three participants simultaneously (one from every site type). Thus, per participant we had six 96 hour outdoor, indoor and personal samples. Concurrently, samples were collected at a central reference site. Results In Helsinki, the median temporal correlation coefficient of the outdoor versus personal exposure ranged from 0.46 for iron and 0.94 for sulfur. In Utrecht, the correlation coefficients varied between 0.35 for copper and 0.95 for sulfur and in Barcelona between 0.28 for silicon and 0.95 for vanadium. Measurements at a continuous reference site were highly correlated with the home outdoor measurements: between 0.87 and 0.98 for S and V and between 0.47 and 0.78 for Cu and Fe in the three cities. Conclusions Overall, the temporal variation in the outdoor concentration of PM2.5 components had a good association with the measured indoor and personal concentrations in all three cities. Elements predominantly found in the fine fraction showed higher correlations.

Abstract Number	**O-1-20-04**
Presenter	Naveen Puttaswamy*, Sudhakar Saidam, Srinivasan Natarajan, Rengaraj Siva, Sathish Madhav, Krishnendu Mukhopadhyay, Sankar Sambandam, Kalpana Balakrishnan
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Reconstruction of daily average PM2.5 exposures in pregnant women: Preliminary results from the SICAPHE study

Background: Impacts of particulate matter (PM exposure) on birth outcomes are increasingly recognized to be important but few efforts have been undertaken to assess PM exposures in pregnant women, especially in developing countries. We report preliminary results from PM2.5 exposure reconstruction exercises from the newly established South Indian Cohort for Air Pollution and Health Effects (SICAPHE) study aimed at generating exposure-response relationships for air pollution and select birth/early childhood outcomes. Aim: To estimate daily average PM2.5 exposures for pregnant women in South India through integration of spatial and temporal variations in area concentrations and duration spent in household microenvironments. Methods: In a sub-set (n=53) of the rural–urban cohort of pregnant women enrolled in the SICAPHE study (n=1200), we measured 24 hour PM2.5 area concentrations in the kitchen, living and outdoor areas using both gravimetric and real-time (UCB-PATS) samplers. Six time windows (4 h each) were identified to cover individual peaks in 24 h real-time records from all households. Average 24 h exposure was calculated by applying the ratio of real-time 4 h to 24 h concentrations to 24 h average gravimetric concentrations and weighting it against the time spent in each microenvironment. Results: The highest 24 h average PM2.5 concentrations were recorded in the kitchens (505±684, 81.7±21.5 and 65.4±27.1 µg/m3, in biomass, kerosene and LPG using households respectively) with much lower concentrations in the living and outdoor areas. Corresponding 24 h average exposures were estimated to be 169±147, 81.7±19.3 and 67.2±68.5 µg/m3. The highest kitchen concentrations were recorded between 6am to 10am and the 24 h exposures were significantly (p=0.047) higher in rural households as compared to urban households. Conclusions: Efforts are underway to validate the exposure reconstructions against personal exposure monitoring to allow exposure estimations for the entire cohort.

Abstract Number	**O-1-20-05**
Presenter	Amit Masih, Ajay Taneja*
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

Indoor/outdoor exposure profiles of gaseous Polycyclic Aromatic Hydrocarbons (PAHs) in a semi arid region of India

A large number of chemical compounds that damage the ambient as well as indoor air quality are formed mostly from combustion sources like gasoline and petrol/diesel fueled automobiles, waste incineration, combustion fuels such as coal, wood, gas and oil, various industrial processes and volatilization from polluted grounds. Polycyclic Aromatic Hydrocarbons are compounds made up of carbon, hydrogen and at least two fused benzene rings in a linear, angular or cluster arrangement. In many circumstances the environmental occurrence of PAHs has been associated with adverse effects on public health. Thus, the aim of this study was to determine gaseous contamination by PAHs and to identify sources in this urban area as well as to assess the carcinogenic potencies related to PAHs. Air samples were taken twice a week with small pumps. The pump was set at 2 L/min. and run continuously for 20 hrs aspirating air through XAD-2 resin retaining PAHs in the gaseous phase. After sampling the XAD-2 resin tubes with Teflon were extracted with methylene chloride and analyzed by GC/MS. Prior to GC/MS analysis, a 1 mL aliquot of the extract was spiked with internal standards. The total indoor/outdoor PAH concentrations were 10.27/4.47, 8.33/5.30, and 7.56/2.54 ng m-3 at urban, roadside, and rural sites respectively. The mean concentration of TPAH was 9.06 ng m-3 at indoor and 4.14 ng m-3 at outdoor for all sites together and the range was from 0.15ng m-3 to 4.88 ng m-3 and 0.10 ng m-3 to 1.80 ng m-3 of indoor and outdoor respectively. The urban site had the highest total indoor PAH concentration followed by roadside and rural site whereas the total outdoor PAH was highest at roadside followed by urban and rural site. The major PAH found in this study were naphthalene > 2-methylnaphthalene > 1-methylnaphthalene, both at indoor and outdoor at all the sites. The correlation coefficient between indoor and outdoor concentrations of PAH shows a positive correlation at all the sites.

Abstract Number	**O-1-20-06**
Presenter	Hsiao-Hsien Leon Hsu*, Robert O. Wright, Brent A. Coull, Stefano Guazzetti, Filippo Donna, Donald Smith, Elza Bontempi, Roberto Lucchini
Exposure	metals
Health domains	no health domain
Type of research	exposure measurement

Associations between Personal Exposure to Airborne Manganese and Biomarkers of Internal Manganese Dose among Children in Northern Italy

Background: Few studies have examined associations between airborne manganese (Mn) and biomarkers at low level exposure and potential confounders or effect modifiers. Aims: To examine associations between airborne Mn and biomarkers of internal Mn dose (blood, hair, nail), controlling for covariates such as age, gender, and blood ferritin in 210 children aged 11-14 years from a cohort in northern Italy. Methods: 24-hr personal air samplings were conducted and filters were analyzed for Mn by Total Reflection X-Ray-Fluorescence. Blood, hair, and nail samples were also collected. Associations between air Mn and biomarkers were examined using multiple linear regressions and generalized additive models (GAMs) with spline terms. Effect modification by gender as well as high (≥median) vs. low air Mn (preliminary analyses using GAMs suggested association patterns might differ in these groups) was examined in stratified models. Results: Median air Mn level was 31.5 ng/m3. Mean (SD) blood, hair, and nail Mn was 11.4 (3.33)μg/L, 0.13 (0.10) μg/g, and 0.20 (0.17) μg/g, respectively. Air Mn was positively associated with hair Mn, while the association was strongest in boys with high air Mn ($p=0.07$). Air Mn was positively associated with nail Mn across both genders ($p=0.09$), and was in general negatively associated with blood Mn ($p<0.01$). Ferritin level was inversely related to blood Mn for children in low air Mn group ($p<0.01$) and to overall hair Mn. Conclusions: Airborne Mn was generally positively associated with hair and nail Mn, but was negatively associated with blood Mn, possibly due to body's self regulating mechanism affecting blood levels more directly. Point measurements of air Mn may not fully capture the exposure pattern, thereby weakening relationships between air and biomarkers which integrate exposures over a specific period of time. Results also suggest that blood ferritin levels may play role in Mn uptake. These exploratory findings warrant further research in low level environmental-biomarker associations.

Abstract Number	**O-1-22-01**
Presenter	Mary B. Rice*, Petter L. Ljungman, Elissa Wilker, Diane R. Gold, Joel D. Schwartz, Petros Koutrakis, George R. Washko, George T. O'Connor, Murray A. Mittleman
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Short-Term Exposure to Air Pollution and Lung Function in the Framingham Heart Study

Background Short-term exposure to higher levels of air pollution has been associated with lower lung function. As air quality has improved in recent years, few adult cohort studies have examined if these associations are still detectable at relatively low levels of ambient pollution. Aims To investigate associations between air pollution and lung function by spirometry in the Framingham Offspring and Third Generation Cohorts. Methods We included 2,920 participants living within 40km of the Harvard Supersite monitor in Boston (3,915 exams between 1995 and 2005) who were not current smokers or on bronchodilators. Moving averages of pollutant concentrations 1, 2, 3, 5 and 7 days prior to spirometry were estimated for fine particulate matter (PM2.5), black carbon (BC), ozone (O3) and nitrogen dioxide (NO2). O3 was considered in the warm season only (April-Sept, 1,888 exams). We fit mixed effects models adjusted for sex, age, height, weight, smoking, education, income, time trends, weekday, season, weather and cohort to estimate associations between air pollutant exposures and FEV1 and FVC. Results Moving averages of PM2.5, BC, NO2 and O3 concentrations 1 and 2 days prior to testing were negatively associated with FEV1 and FVC, with the strongest associations with NO2 and O3. An interquartile range (IQR) increment in pollutant level 1 day prior to testing was associated with a lower FEV1: -8.6mL (95% CI: -16.1, -1.2) for PM2.5, -6.2 mL (95% CI: -13.7, 1.3) for BC, and -13.0mL (95% CI: -22.3, -3.8) for NO2. Similar associations were seen with FVC. In the warm season, FEV1 was 28.9mL lower (95% CI: -52.9, -4.9) per IQR of O3 1 day before testing and similar associations were seen for all moving averages of O3 with both FEV1 and FVC. Conclusions In the setting of relatively low ambient air pollution levels, short-term exposure to air pollutants was associated with lower lung function. For O3 exposure in the warm season, the magnitude of the associations with FEV1 and FVC were larger and persisted for longer (7 day) exposure periods.

Abstract Number	**O-1-22-02**
Presenter	Elaine Fuertes*, Elaina MacIntyre, Ulrike Gehring, Olena Gruzieva, Claudia Klümper, Anna Mölter, Göran Pershagen, Daniela Porta, Marta C. Pradas, Joachim Heinrich
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	meta-analysis

Associations Between Particulate Matter Constituents And Early-Life Pneumonia In Seven Birth Cohorts: Results From The TRANSPHORM Project

Background: Evidence for an association between traffic-related particulate matter (PM) and pneumonia in early childhood was found by the ESCAPE project. Which, if any, specific particle matter (PM) constituent(s) are primarily responsible for this adverse health outcome is unknown. Aim: Using a standardized approach, we aimed to assess the association between PM constituents and pneumonia during the first years of life in seven birth cohort studies: BAMSE (Sweden), GASPII (Italy), GINI and LISA (Germany), INMA (Spain), MAAS (The United Kingdom) and PIAMA (The Netherlands). Methods: Concentrations of eight PM constituents (copper, iron, potassium, nickel, sulfur, silicon, vanadium, and zinc), each respectively derived from particles with aerodynamic diameters less than 10µg/m³(PM10) and 2.5µg/m³ (PM2.5), were calculated using land-use regression models developed from a common protocol as part of the TRANSPHORM project. Constituent concentrations were individually assigned to each child's birth address (Ntotal=15,775). Logistic regression models assessed cohort-specific associations between parental report of physician-diagnosed pneumonia during the first two years of life (three for MAAS) and each constituent. Models were adjusted for relevant host and environmental covariates and for total PM10 or PM2.5, depending on the origin of the constituent. Random-effects meta-analysis was used to obtain combined estimates. Results: Pneumonia was associated with zinc derived from PM10 (1.53 [1.04, 2.25] per 20ng/m³ increase) and potassium derived from PM2.5 (1.78 [1.07, 2.97] per 50ng/m³ increase) in the fully adjusted models.. Estimates for zinc derived from PM2.5 were elevated but non-significant (1.31 [0.98, 1.75] per 10ng/m³ increase). Conclusions: Results from a multi-center analysis of seven European birth cohorts indicate that zinc and potassium derived from traffic-related PM increase the risk of pneumonia in the first years of life. Zinc has been associated with tire wear.

Abstract Number	**O-1-22-03**
Presenter	Pieter Goeminne, Michal Kicinski, Francois Vermeulen, Frans Fierens, Kristiane De Boeck, Benoit Nemery, Tim S. Nawrot*, Lieven J. Dupont
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-crossover study

Impact of air pollution on cystic fibrosis pulmonary exacerbations: a case-crossover analysis

BACKGROUND: Pulmonary exacerbations in Cystic Fibrosis (CF) contribute to the burden of disease with negative impact on quality of life, cost and lung function. AIM: Our aim was to evaluate if exacerbations, defined by antibiotic use, were triggered by daily fluctuations in air pollution. METHODS: In a case-crossover analysis we evaluated 215 CF patients and pollution data from 1 January 1998 till 31 December 2010. Exacerbation was defined as the start of intravenous and/or oral antibiotics use in a home or hospital setting. We calculated regional background levels of PM10, ozone and NO2 on the day of the event, and on the 2 days prior to the event at each patient's home address. We matched for day of the week and controlled for temperature on the day of the event and the two preceding days. In the month where antibiotic treatment was started, all days with the same temperature (±2°C) as the event day served as control days, while excluding three days before and after the start of treatment. RESULTS: A total of 215 patients (male 49%, mean age 21 years ± 13) had 2204 treatments (1107 intravenous and 1097 oral antibiotic treatments). Over a period of 12 years, an increase in risk of antibiotic use was associated with increasing concentrations of PM10, NO2 and ozone on the event day and the day before for NO2. A tendency toward significance was seen the day before antibiotic use for PM10 and ozone. Overall, a rise in odds ratio was seen from two days before till the day of the start of antibiotics. CONCLUSION: In patients with CF and exacerbations, ambient concentrations of ozone, PM10 and NO2 play a role in triggering an exacerbation.

Abstract Number	**O-1-22-04**
Presenter	Liliia Petruk*, Olena Turos, Liudmyla Mykhina
Exposure	others
Health domains	other
Type of research	health impact assessment

Children respiratory health in relation to indoor air quality in schools

The research was performed in terms of theInternationalproject“SchoolEnvironmentand RespiratoryHealthofChildren” (SEARCH II), which was conducted in 10 Europeancountries, including Ukraine. The project’s part “Environmental monitoring in school buildings” aims to identify the relationship between the children comfort conditions and indoor air quality in classrooms. The indoor air monitoring in schools was performed using following methods: continuous sampling for measurement of PM10 (Haz-Dust EPAM-5000) and CO/CO2/T/RH (TSI IAQ); passive sampling to estimate formaldehyde, VOCs/BTEX and NO2 (RADIELLO passive samplers). For the project implementation 10 schools in different districts of Kyiv were selected. In each school 4 classes were chosen (100 students aged 9-11 years). The field study was performed during the heating period (February-April). The total sampling duration was 4 days: continuous sampling indoors – one day per classroom during working hours, outdoors – 20-30 minutes before and after classes every day; passive sampling indoors and outdoors – from first to last day. The study revealed that measured CO2 concentrations as high as up to 1000 ppm during the working hours; the temperature was going up from 18 oC during the morning hours to 25 oC by the end of the classes; the relative humidity was in the range from 30% to 45%. The measured concentrations of indoor air pollutants were within the range: BTEX – (0.005-0.016) mg/m3; formaldehyde – (0,005-0,025) mg/m3;NO2 – (0.003-0.024) mg/m3. To conclude, the main school problems in Kyiv during the heating season are attributed to the absence of proper ventilation system and control over the microclimate in classrooms, which is the primary cause of students’ uncomfortable feeling and negative health effects. The defined results will be used in developing recommendations for Ukrainian schools related to the comfort conditions for students and finishing works inside school buildings.

Abstract Number	**O-1-22-05**
Presenter	Eline Provost*, Agnès Chaumont, Michal Kicinski, Bianca Cox, Frans Fierens, Alfred Bernard, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Serum levels of Clara cell protein and short- and long-term exposure to particulate air pollution in adolescents

Background: Studies in populations have shown that particulate air pollution is associated with changes in lung function in adolescents. Objective: We investigated the effect of short- and long-term exposure to particulate matter (PM10) on pulmonary health of adolescents, using serum lung Clara cell protein (CC16) as a biomarker for respiratory epithelium integrity. Methods: We measured serum CC16 in 825 adolescents (57% girls, mean age: 15 years). Short-term and long-term exposure to ambient PM10 was estimated for each participant's home address using a kriging interpolation method. To explore the relationship between PM10 and serum CC16 we applied restricted cubic splines with 5 knots located at the 5th, 25th, 50th, 75th and 95th percentiles of the PM10 distribution. Results: After adjustment for potential covariates, the analysis showed strong associations between PM10 concentrations during a preceding week and serum CC16 levels. An increase from 20 to 30 µg/m³ in mean PM10 in the week before clinical examination was associated with a substantial increase of 0.93 µg/l (0.14 to 1.17, p=0.021) in serum CC16 levels. The association flattens at higher concentrations (mean week averages of more than 30 µg/m³). There was no evidence of an association between long-term exposure to PM10 and serum CC16 concentrations. Conclusions: Our findings suggest that short-term exposure to particulate air pollution may compromise the integrity of the lung epithelium and lead to increased epithelial barrier permeability in the lungs of adolescents, even at low concentrations.

Abstract Number	**O-1-22-06**
Presenter	Sandrah Eckel*, Kiros Berhane, William Linn, Muhammad Salam, Edward Rappaport, Theresa Bastain, Frank Gilliland
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Statistical methods for airway and alveolar nitric oxide in environmental epidemiology

Background: The fractional concentration of exhaled nitric oxide (FeNO) has been used as a non-invasive biomarker of airway response to inhaled environmental exposures. FeNO measured at multiple flow rates can now be partitioned into proximal (airway) and distal (alveolar) sources using statistical models based on mathematical models of lower respiratory tract physiology. There is strong potential to improve our understanding of inflammatory mechanisms induced by inhaled exposures by studying effects on airway and alveolar NO, but current statistical methods may not be well-suited to epidemiologic studies. Aims: Evaluate the statistical properties of two methods to quantify exposure effects on airway and alveolar NO: (1) standard two-step approaches (estimate airway and alveolar NO separately for each person, and then relate airway and alveolar NO estimates to the exposure) and (2) unified non-linear mixed effects model approaches novel to this application. Methods: We simulated 500 sets of 500 multiple flow FeNO datasets similar to those collected in 1640 children participating in the southern California Children's Health Study (2 measurements of FeNO each at flow rates 30, 50, 100, and 300 ml/s). FeNO was generated by adding random error to theoretical FeNO from a two-compartment model in which alveolar or airway NO was a function of a continuous exposure. Results: Two-step approaches were underpowered compared to mixed-effects approaches. In one simulation, the power to detect the exposure effect was: (a) 0.56 and 0.80 for alveolar NO, and (b) 0.72 and 0.81 for airway NO, respectively for the 2 methods. Both approaches had negligible bias. Conclusions: When studying airway and alveolar NO, a mixed-effects approach can considerably improve power to detect determinants, particularly for alveolar NO. Improved methods are highly relevant for studying compartmental airway response to ambient air pollution exposure, and will be implemented in the Children's Health Study.

Abstract Number	**O-1-23-01**
Presenter	Pantelis Charisiadis*, George Christodoulou, Konstantinos C. Makris
Exposure	drinking water
Health domains	reproductive outcomes
Type of research	cross-sectional study

Human Exposure Assessment using Drinking-Water and Urinary Trihalomethanes Concentrations in Two Areas with Contrasting Urban Pipe Network Characteristics

Complaints about chlorine smells due to high dosing, formation of disinfection by-products, or inadequate chlorination are common issues that authorities frequently deal within urban drinking-water distribution systems. The large spatial variability of trihalomethanes (THM) formation in drinking-water within the same pipe network of a city is perplexing, often influenced by factors, such as water source characteristics, water chemistry within the pipe network and its physical characteristics. This study set out to evaluate the magnitude and variability of human exposures to THM in two urban areas both located in the same city, but carrying contrasting pipe network characteristics (number of pipe leaking incidents, pipe length, pipe material, number of water meters, and average minimum night flow). Our cohort was comprised of 382 volunteers from the general population that completed a questionnaire about drinking-water consumption habits, water source/uses, demographics, and disinfectant use in households. Tap water and first morning urine samples were collected and analyzed for THM using gas chromatography coupled with triple quadrupole mass spectrometry. Results will highlight the spatial variability of THM concentrations using both external (water) and internal (urine) exposure measurements after adjusting for common environmental/ lifestyle covariates. The influence of pipe characteristics, participant water consumption and household disinfection practices on the distribution, formation and subsequent human absorption patterns will be elaborated.

Abstract Number	**O-1-23-02**
Presenter	Laura Beane Freeman*, Kenneth P. Cantor, Dalsu Baris, John R. Nukcols, Karla Armenti, Chris Paulu, Alison Johnson, Jay H. Lubin, Margaret Karagas
Exposure	drinking water
Health domains	cancer
Type of research	case-control study

Disinfection By-Products and Bladder Cancer in a Case-control Study in New England

Background: Ingestion of disinfection by-products (DBPs) has been associated with bladder cancer in multiple studies. More recently, other routes of exposure have been implicated. Trihalomethanes (THMs) are a class of DBPs commonly found and regulated in public water supplies. Aims: In a large population-based case-control study in New England, we evaluated exposure to THMs through ingestion and showering/bathing, as well as use of swimming pools in relation to bladder cancer. Methods: Study participants provided information about their residential and work histories, water ingestion, showering/bathing habits and use of swimming pools at various ages. Residences were geocoded, and linked to utilities using a geographic information system. Historical measurement and water source data were collected from a variety of sources, and combined with the residential and work histories and ingestion data to calculate several metrics of THM exposure. We also multiplied frequency of showers/baths and residential THM level. We calculated odds ratios (ORs) and 95% confidence intervals (CI) for ingestion, showering/bathing and use of swimming pools, using unconditional logistic regression, adjusted for confounders such as age, gender, state, high-risk occupation, smoking, and ethnicity. Results: Among 974 cases and 1,184 controls, we observed a small increased risk, but only in the highest 5% of average THM concentration (OR=1.3, CI:0.8-2.0, p-trend=0.4); no increased risk was apparent below 46 mg/L. Showering/bathing was not associated with bladder cancer (OR=0.9, CI: 0.6-1.5, for highest exposure, p-trend=0.9), nor was use of swimming pools (OR=0.9, CI: 0.8-1.1 for ever use). Conclusions: Similar to other studies, we observed a modest increase in bladder cancer with THM levels above about 50 mg/L. Data from this study do not support a role of showering or bathing or the use of swimming pools with bladder cancer in the New England population.

Abstract Number	**O-1-23-03**
Presenter	Tim K. Takaro*, Lindsay Galway, Diana Allen
Exposure	drinking water
Health domains	infectious diseases
Type of research	time series study

Water resources in a changing climate: Gastrointestinal illness as a sentinel for water quality

Background Diarrheal disease causes significant mortality and morbidity around the world. Extreme weather events increase the risk of diarrheal illness by contaminating water sources during high rainfall run-off and flood events or during droughts. These extreme events are increasing in frequency and intensity, a trend that is expected to worsen. British Columbia (BC), is a large Canadian province with very diverse hydrological regimes and therefore a useful place to study vulnerability to water stress. The study communities were selected to represent different hydro-climatic regimes and residential drinking water sources. Aim To examine the role of season, water source and pathogen type in sporadic gastro-intestinal (GI) illness in different hydro-climatic regimes over an eleven year period 1999-2009. Methods and Results 2,308 cases of laboratory confirmed reported campylobacter, verotoxic E. coli, salmonella, giardia and cryptosporidium were analyzed. Three methods were used to characterize the seasonality of GI illness; time-series plots, monthly plots and spectral analysis. Using three methods allowed for triangulation of results and a more in depth understanding of seasonality. Each of these three methods was applied to all 8 communities aggregated in a time-series, as well as the time-series disaggregated by hydro-climatic regime, drinking water source, and pathogen type. Our results indicate that mixed systems are more hazardous than surface water or groundwater alone, cases occurring in snow melt-dominated watersheds peak in July vs. September for rain dominated regimes, and parasitic infection peaks about 6 weeks after bacterial. We are also exploring environmental risk factors for GI illness including temperature, rainfall extremes and high flows in source river systems. Conclusions Local research using GI illness data can highlight seasonal patterns, risk factors and identify vulnerabilities for municipal water systems. Such tools will be critical for planning adaptive measures for potable water in a changing climate.

Abstract Number	**O-1-23-04**
Presenter	Bhupali Mhaskar*
Exposure	drinking water
Health domains	healthrelated quality of life
Type of research	review

Making Sanitation a Clean Habit: A School Sanitation Project in India

Introduction: Access to safe water and sanitation is a fundamental human right. In India, despite programmatic interventions poor access to safe drinking water and hygiene habits affect 38 million annually with water borne diseases & 1.5 million children die of diarrhea[1]. A Sanitation Project (WOTR 2008) explored the role of school children as effective change agents. Going further from the initial project, WOTR[2], India implemented a School Sanitation Project in 24 villages in Maharashtra state, covering 66 schools in 2011. Methodology: The project aimed at creating a hygiene culture among children by promoting healthy behavior with structural interventions. The study included school children from 3 to 13 yrs. Structural interventions included construction of water supply system, drainage, solid waste management & toilets. Behavioral interventions included teaching children water management & sanitary practices. Cluster workshops for school teachers and community members were held to ensure continuity. Village Education Committee[3] was the main stakeholder of project. Results: All schools were provided secured water supply, school children have started using the sanitation facilities hence, open air defecation is almost nil. Water supply systems are operated & maintained by children and school authorities that ensure sustainability. Hygienic sanitary practices are found to spill over to homes. Girls are comfortable attending schools as separate toilets are available. Healthy habits ensure increased school attendance and performance. Conclusion: Children are effective change agents ensuring sustainability. School sanitation projects should optimally utilize student resource to ensure a healthy and productive generation. Addressing water and sanitation play a big role in adapting to climate change. [1] Drinking water quality in rural India: Issues and approaches: Background paper, Water Aid [2] WOTR- Watershed Organization Trust [3] Village Education Committee- a local legal institution subcommittee of Gram Panchyat

Abstract Number	**O-1-23-05**
Presenter	Tintin Farihatini*, Peter Davey, Patricia Dale, Newell Johnson
Exposure	drinking water
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Environmental Impact on Human Health: The Association between Drinking Water Quality and Teeth Decay in School Children in South Kalimantan Province, Indonesia

Background: In some areas in Indonesia, such as South Kalimantan province, water quality has been a problem due to natural environmental hazards and anthropogenic activities. Indonesian Basic Health Research Survey (2008), showed that the prevalence of dental decay was high (83,6 %) and much of the drinking water quality was poor (58,6 %). Aim : This environmental risk factor research investigates the association between drinking water quality and tooth decay in school children. Methods: Quantitative & Qualitative methods are used in a cross sectional study, with oral health examinations of 300 school children (5-7 years old) in 20 villages, 3 districts, in South Kalimantan Province. Interviews were to investigate social risk factors. Drinking water samples were collected from 20 villages and examined in the laboratory. Results: The prevalence of teeth decay is 99,7% On average there are 11 decayed, exfoliated or filled deciduous teeth per person. Laboratory findings showed that 30 % of drinking water is outside the normal pH range of 6.5-8.5. 95 % of Fluoride concentration is below the optimum level (0.7 ppm) to prevent dental caries. In certain areas, manganese concentration of 8.75 ppm exceed the safety level of 0.4 ppm. Bivariate analysis showed significant correlations ($p<0.05$); the more acidic water, the lower the fluoride, the higher the dental caries. Manganese is positively correlated with dental caries. These findings support the people views that they have tooth decay due to poor quality water. The Governor once said “many teenagers failed the health examination of Army School entry test. Mostly due to teeth decay”. Hence, tooth decay also reflects poor environmental conditions and has consequences for future socio-political life, education & employment. Conclusion: Tooth decay is highly prevalent related to poor drinking water quality in certain areas. This needs to be taken into account as a potential indicator of general environmental problems.

Abstract Number	**O-1-23-06**
Presenter	Iman Al-Saleh*, Mai Abduljabbar, Reem Al-Rouqi
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Predictors of mercury (Hg) exposure in breast-fed infants

This study was designed to investigate potential factors that might affect Hg exposure in mothers and their breast-fed infants. Total Hg was measured in the urine and breast milk of 155 mothers (18-42 yrs) and 102 infants (2.5-12.8 mon) living in Riyadh, the Capital of Saudi Arabia. The median (25th-75th) of Hg levels in mother’s urine, breast milk, and infant’s urine were respectively: 0.98 (0.6-1.68µg/g-Cr), 1.08 (0.77-1.40µg/L), and 5.27 (1.97-10.09µg/g-Cr). 48% of mothers and 89% of infants had urinary Hg>1µg/g-Cr (the GerES reference value for adults and children without amalgam fillings). Though Hg in the urine of mother and their infants were correlated (P=0), borderline significant relationship was found between Hg in mother’s urine and breast milk (P=0.077). Bivariate analysis revealed that the use of skin-lightening creams was significantly associated with Hg in mother’s urine (P=0.029) and breast milk (P=0.048). The location of current residence was related to Hg in infant’s urine (P=0.002) and mother’s milk (P=0). Only Hg in infant’s urine was associated with smoking status (P=0.025). Urinary Hg levels were significantly higher in infants who are taking milk formula (P=0.022). No association was seen between the use of dental amalgam fillings or fish consumption and the levels of Hg in the urine or breast milk. Among demographic and socioeconomic factors, only parity (P=0.01), and the number of breast-fed children (P=0.005) had a negative effect on Hg in breast milk. Likewise, there was negative association between infant’s age and their urinary Hg levels (P=0.046). The results of the present study confirm the transfer of Hg from the mother to infants through breast-feeding. Though there might be other sources of Hg exposure that need further investigation, our current findings corroborate our earlier observation linking elevated levels in Hg to the use of skin-lightening creams.

Abstract Number	**O-1-25-01**
Presenter	Jutta Lindert*, Paul Bain
Exposure	others
Health domains	healthrelated quality of life
Type of research	review

Well-being as outcome for health monitoring in environmental epidemiology

Aims and background: Well- being is a relatively new outcome related to health and diseases. Self-reported subjectives outcomes in well-being monitoring and research are based on the traditions of “hedonia” and “eudaimonia”. Hedonic approaches assess life satisfaction and affects; eudaimonic approaches assess and meaning and purpose in life. The aim of this review is to give account of identified self-report instruments with used in individuals aged >15. Methods: Systematic review of instruments used in original studies published in PubMed 2007-2012, evaluation of properties of instruments. Results: Following an evaluation of 1,321 papers, we identified 70 instruments. Domains in the instruments were: life satisfaction, positive affects, negative affects, health, activities / vitality, spirituality, and cognition. Number of items varied between 1 and 84; none of the instrument fulfilled all criteria. Conclusions: Well-being as outcome in environmental epidemiology should be monitored with validated instruments; and link subjective and objective indicators of well-being.

Abstract Number	**O-1-25-02**
Presenter	Lan Li*
Exposure	others
Health domains	healthrelated quality of life
Type of research	occupational study

Investigation on the thermal comfort requirement of sleeping people

Sleep is essential to help the body recover from both physical and psychological fatigue suffered throughout the day. Ambient temperature is one of the factors that affect sleep quality. There are relatively few researches focusing on the thermal comfort requirements of sleeping people. The design and operation of air-conditioning system in bedroom are usually based on the standards and criterions specified for office building when people are awake. The main objectives of this study are to find out the effect of indoor temperature on occupant’s sleep quality, and whether there is difference in thermal comfort requirement of sleeping people. Eighteen participants (9 males and 9 females) were recruited in the experiment. They slept in three thermal environments (with ambient temperature of 23oC, 26oC, and 30oC) repeatedly in balanced order during the summer season. The resistance of the covering materials including the clothing was estimated to be 1.8 clo. The participants filled out questionnaires on thermal comfort before and after sleep. They assessed their sleep quality after they get up. During sleep, the electroencephalograms (EEG) and skin temperature of the participants were continuously measured. The results show that the indoor temperature has a significant effect on sleep quality. At 26 oC, the relative power of the EEG δ was the highest, indicating a better sleep quality at this temperature. The neutral temperature is reported to be higher when people are sleeping than that for awaking. Therefore, it is needed to establish standards regarding thermal comfort specifically for sleeping environment. The skin temperatures of the participants were significantly affected by the indoor temperature; it increased with the indoor temperature. Moreover, their skin temperature changed significantly during the entire sleep period. Creating a transient thermal environment for the bedroom based on people’s physiological characteristics at different sleep stages may be benefit for improvement of sleep quality.

Abstract Number	**O-1-25-03**
Presenter	Budi Haryanto*, Ratu Ayu Dewi Sartika
Exposure	others
Health domains	other
Type of research	randomized trial

Effect of multivitamin supplementation on employees' sick building syndrome frequencies in Jakarta, Indonesia

This study investigates the effects of intervention with a tailored multivitamin supplement containing of antioxidants on the frequency of Sick Building Syndrome (SBS, i.e. symptoms headache, watery eyes, throat irritation, dry cough, dry and itchy skin, dizziness, sickness, fatigue, inability to concentrate, etc.) in employees in Jakarta, Indonesia. The supplement used consisted of vitamins A, D, E, C, B6, B12, folate, selenium, zinc, iron and copper and is marketed in Indonesia as Redoxon Fortimun. The research was conducted in 350 employees (25-50 years old) in 18 different companies in Jakarta. Eleven companies were selected randomly whose employees were given the supplement to be consumed daily for 3 months. Meanwhile, employees from 7 other companies not consuming the supplement served as the control group. The results showed that 50% of people working in office buildings experienced SBS but major differences were seen between the supplement and the control groups. The micronutrient supplement was proven to significantly reduce the following frequencies: 49% less headache, 45% less watery eyes, 52% less nasal congestion, 27% less respiratory infection and 41% less fatigue. These results conclude that 3 month supplementation containing antioxidants resulted in a significant reduction of sick building syndrome frequencies in employees exposed to air pollution experienced in a big city such as Jakarta.

Abstract Number	**O-1-25-04**
Presenter	Tee L. Guidotti*, David Lukcso, Don Franklin, Allan Burt, Tee L. Guidotti
Exposure	others
Health domains	healthrelated quality of life
Type of research	health impact assessment

Building-Related Symptoms and Characteristics in a Sensitive Multiple-Use Complex

We investigated environmental conditions by many modalities in 71 discreet areas of 12 of 40 buildings in a sensitive government building complex. An on-line health survey was completed by 7,637 building occupants (49% response rate), a subset of whom voluntarily underwent medical evaluation. Few environmental conditions directly correlated with individual clinical endpoints, except that low relative humidity was significantly associated with lower respiratory and "sick building syndrome"-type symptoms. Five environmental factors were associated with group-level building-related health complaints: physical comfort, odor, job stress, glare, cleanliness, renovation and construction activity, and noise. The most common physician-diagnosed disorders reported by respondents were sinusitis, allergies, and asthma. The clinical diagnosis of asthma was associated with increased absence and presenteeism (presence at work but at a reduced capacity) and reports of symptoms, including those not related to respiratory disease. This investigation supports a recommended approach to assessment of building-related health complaints, that the assessment should begin with an occupant-centered medical evaluation in order to guide environmental investigations, rather than relying primarily on building-wide indoor environmental surveys.

Abstract Number	**O-1-25-05**
Presenter	Kyung Sul*, James Farnsworth, Andrea Ferro
Exposure	other
Health domains	healthrelated quality of life
Type of research	exposure modeling

Modeling of indoor air particles with resuspension for an occupied commercial building

As people spend most of their time indoors, identifying pollutant concentration in indoor air is important for examination of human exposure. Resuspension via human activity is known as a significant source of particulate matter in indoor air. In this study, a model was developed to predict concentration of indoor particles in an occupied commercial building. The model considers resuspension from human activity and number of people in each targeted area. A materials balance method was used to calculate the concentration for each particle size bin. Population in each room was counted from entry and exit data of employees. Optical particle counters measured particle concentration in modeled area. Results from the model simulation were compared with measured concentrations and showed good agreement.

Abstract Number	**O-1-25-06**
Presenter	Raymond Neutra*
Exposure	no exposure
Health domains	ethics
Type of research	others

The Public's Health: Right or Means to Gross National Happiness? (e*)

There are two different ways one could look at the activities of a society's health sector as it offers prevention, cure, management and heartfelt care (when the first three fail). The first way considers that the community has a duty to provide whatever it takes to allow each individual to achieve the age, functionality and health status that he or she desires. The other view is that the health sector's activity is only one of many means to create conditions that increase the probability of a society with civic engagement and room for individuals to attain their potential; a means to a larger end, not an end in itself. From this perspective one is not obliged to prioritize individual desires to achieve an age or some other health related health endpoint for themselves that when widely practiced would cause problems for society at large. The desire to have male children is one such example. What would the societal impact be if many people lived to be 150? Is there something to be learned from an intellectual exercise in which one attempts to set health sector priorities to further the good of society as a whole and not to simply provide all available health technology that individuals demand?

Abstract Number	**O-1-26-01**
Presenter	Silvia Narduzzi*, Daniela Porta, Fiorella Fantini, Francesco Blasetti, Roberta Turci, Claudio Minoia, Francesco Forastiere
Exposure	persistent organic pollutants
Health domains	diabetes
Type of research	cross-sectional study

Effects of Beta-Hexachlorocyclohexane on Diabetes and Blood Concentration of Lipids

Introduction: Recent studies suggest that exposure to β-Hexachlorocyclohexane (β-HCH) may be associated with an increased risk of type 2 diabetes and obesity-related metabolic disorders. A biomonitoring study, conducted on residents in the Sacco Valley (Italy), found high values of β-HCH in people living close to the river, which have been subjected to an epidemiological and health surveillance. Aims: To evaluate the effects of β-HCH serum concentration on diabetes and blood levels of lipids among people living within 1 Km from the Sacco River. Materials and Methods: The outcomes considered were diabetes/prediabetes, fasting plasma glucose and glycosylated haemoglobin, total cholesterol, HDL and LDL cholesterol, triglycerides, body mass index (BMI). Wet-weight concentration of β-HCH (ng/mL) in quartiles was used as the exposure variable. Linear regression analysis was used to study the association with continuous biochemical parameters (log scale) expressed as GMR, and multinomial logistic regression model was used to study the association with categorical outcomes, expressed as OR. Analyses were adjusted for gender, age class, educational level, smoking habits and, according to circumstances, BMI, body weight variation, cholesterol, triglycerides, diabetes. Results: 496 subjects were enrolled in the study (90% participation). β-HCH concentration ranged between 0.02 and 8.29 ng/mL. β-HCH was positively associated with triglycerides (GMRβ-HCH>75°pct =1.19, 95%CI=1.05-1.35; ORhigh=1.32, 95%CI=1.02-1.71) and inversely associated with HDL cholesterol for all categories (GMRβ-HCH>75°pct=0.86, 95%CI=0.81-0.92; ORlow=1.29, 95%CI=1.02-1.63). There was weak or no evidence of association with the remaining outcomes. Conclusions: Although reverse causation cannot be excluded, the results of this study suggest that environmental exposure to β-HCH may increase the risk of having high total and LDL cholesterol, high triglycerides and low HDL cholesterol in the general population.

Abstract Number	**O-1-26-02**
Presenter	Hong Chen*, Richard T. Burnett, Jeffrey Kwong, Paul J Villeneuve, Mark Goldberg, Robert Brook, Aaron van Donkelaar, Michael Jerrett, Randall V. Martin, Jeffrey Brook, Ray Copes
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cohort study

Risk of Incident Diabetes in Relation to Long-term Exposure to Fine Particulate Matter in Ontario, Canada

Background: Ambient fine particulate matter (PM2.5) has been linked to cardiovascular mortality and morbidity, possibly arising from systemic inflammation, endothelial dysfunction, and oxidative stress, which may induce vasoconstriction and insulin resistance. Method: To determine whether long-term exposure to PM2.5 is associated with incident diabetes, we assembled a cohort of 62,012 nondiabetic adults who lived in Ontario, Canada, and who completed one of five population-based health surveys between 1996 and 2005. We also assembled a second cohort comprising the entire adult population of Ontario between 1996 and 2010 (~7 million). Follow-up extended until December 31, 2010. Incident diabetes, mostly type-II, among cohort members was ascertained using the Ontario Diabetes Database, a validated registry (sensitivity=86% and specificity=97%). Long-term annual mean concentrations of PM2.5 at the residences of subjects were derived from satellite observations. We used Cox proportional hazards models, adjusting for numerous individual and contextual risk factors such as hypertension, body-mass index, smoking, diet, and neighbourhood income. We repeated the analysis for the entire Ontario cohort, but adjustment was limited to fewer covariates. We conducted several sensitivity analyses, including, assessing the impact of residential mobility on the effect estimates and examining whether the effects of PM2.5 changed over time. Results: Between 1996 and 2010, yearly incidence rate of diabetes in both cohorts was about 12 per 1000. In the analysis of the cohort from the surveys, for every 10µg/m3 increase of PM2.5, the adjusted hazard ratio (HR10) was 1.11 (95% confidence interval (CI): 1.02-1.21). For the entire Ontario cohort, we observed an adjusted HR10 of 1.15 (95%CI: 1.14-1.15). The estimates of association were unchanged in our sensitivity analyses. Conclusions: Results from this study contribute to a small, but growing body of literature suggesting an association between PM2.5 and development of diabetes.

Abstract Number	**O-1-26-04**
Presenter	Kristina Mattsson*, Karin Källén, Matthew Longnecker, Anna Rignell-Hydbom, Lars Rylander
Exposure	others
Health domains	diabetes
Type of research	cohort study

Maternal smoking during pregnancy and daughters' risk of gestational diabetes and obesity

BACKGROUND: Adverse health effects of prenatal exposure to maternal smoking may persist until adulthood. For example, Norwegian women exposed to tobacco smoke in utero were at higher risk of developing gestational diabetes (GDM), and whether this association is present elsewhere is an open question. AIMS: To study the risk of developing gestational diabetes in women who were exposed to tobacco smoke in utero. Secondary aims were to assess the risk of obesity and non-gestational diabetes. METHODS: Data were retrieved from the Medical Birth Register of Sweden for women who were born in 1982 (smoking data first registered) or later and who had given birth to at least one child; 80 189 pregnancies were included. The associations between in utero smoking exposure (three categories: non-smokers, 1-9 cig/day [moderately exposed], and >9 cig/day [heavily exposed]) and subsequent gestational diabetes (n=291), non-gestational diabetes (n=280) and obesity (n=7309) were assessed. RESULTS: The adjusted odds ratios (aOR) of gestational diabetes were increased among women who were moderately (aOR 1.63, 95% confidence interval (CI): 1.24-2.13) and heavily exposed (aOR 1.52, CI: 1.12-2.06). The corresponding odds ratios of obesity were (aOR 1.36, CI: 1.28-1.44) and (aOR 1.58, CI 1.48-1.68), respectively. A reduced odds ratio for non-gestational diabetes was seen in the offspring of heavy smokers (aOR=0.66, CI: 0.45-0.96). CONCLUSION: Women exposed to smoking during fetal life were at higher risk of developing gestational diabetes and obesity.

Abstract Number	**O-1-26-05**
Presenter	Stefanie Lanzinger*, Susanne Breitner, Lucas M. Neas, Wayne E. Cascio, Alan Hinderliter, Annette Peters, Robert B. Devlin, Alexandra Schneider
Exposure	climate change (temperature)
Health domains	diabetes
Type of research	others

Interactive Effects between Air Temperature and PM2.5 on Endothelial Function in Diabetic Individuals

Background: Several studies have reported an association between particulate matter and endothelial dysfunction. Only a few studies have examined the impact of air temperature on endothelial function and little is known about the interactions between temperature and particulate matter. Aims: The objective of our analyses was to investigate short-term effects of temperature as well as interactive effects between temperature and particulate matter with an aerodynamic diameter ≤2.5 µm (PM2.5) on endothelial function. Methods: Between November 2004 and December 2005 flow-mediated dilatation (FMD), a marker of endothelial dysfunction, was measured using brachial artery ultrasound on four consecutive days in 22 individuals with type-2 diabetes mellitus in Chapel Hill, North Carolina (USA). Daily measurements of meteorological and PM2.5 data were obtained from a central rooftop monitoring site. In order to assess temperature effects and the interaction between temperature and PM2.5 on FMD we used additive mixed models adjusting for time‐trend, day of the week, relative humidity and barometric pressure. For analyzing interactive effects, PM2.5 was divided into low (<25%-quartile), medium (25%‐74%) and high (≥75%‐quartile) concentrations. Results: A 1°C decrease in temperature was associated with an immediate (same day) as well as delayed decreases in FMD mean with a delay of one and four days (3.9% (95%‐confidence interval:[‐6.5;‐1.2%])). Increasing PM2.5 concentration strengthened the association between temperature and FMD. Temperature effects on FMD were more pronounced in association with high (-6.3% [‐10.7;-1.8%]) PM2.5 concentrations compared to medium (‐3.5% [-6.5;-0.4]) concentrations with a delay of four days.Conclusions: We detected an association between a decrement in temperature and decreases in FMD. Moreover, a significant interaction between temperature and PM2.5 on FMD was found. Our findings support the hypothesis that temperature and PM2.5 might have synergistic effects on health outcomes.

Abstract Number	**O-1-26-06**
Presenter	Christine Rioux, Katherine L. Tucker, Doug Brugge*, Mkaya Mwamburi
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cohort study

Longitudinal Assessment of Associations between Residential Traffic Exposure and Type 2 Diabetes (T2D) Development and Progression

Background: Puerto Ricans have disproportionately high rates of T2D and uncontrolled T2D (40% for ages 45-75 y in Boston, MA) and many live near major roadways. Aims: To investigate whether the development and progression of T2D over a 2-year follow-up period is associated with traffic exposures and whether medication types mediate these associations. Methods: Using multiple linear regression and controlling for several health and demographic covariates and type of diabetes medication, we tested for associations between traffic exposures (proximity to roads with >20,000 vehicles/day and traffic density at the neighborhood level and changes in T2D status (either on diabetes medications or glucose > 126 mg/L) and changes in T2D-related outcomes. T2D outcomes included HbA1c levels, HOMA-IR, serum and plasma triglycerides, HDL and LDL. Risk factor outcomes included blood pressure measures, c-reactive protein, BMI and waist circumference. We examined interaction between medication type and the exposure variables. Results: We previously reported that levels of inflammatory markers were associated with residential traffic exposure in this population. Individuals using insulin were observed to have a pro-inflammatory response reflected in higher levels of CRP with increased traffic exposure, while those on oral hypoglycemic agents (OHAs) were observed to have lower CRP levels with increased traffic exposure. Preliminary results of our longitudinal study indicate that from baseline to the 2-yr follow-up, the percent of those with diabetes increased from 39.9% to 42.1%. We are exploring the role of continuous exposure to elevated traffic exposure. We aim to further understand whether OHAs confer any protective effects from traffic exposure, as well as any possible impacts on disease progression in this context. Conclusion: T2D has increased in this study cohort over just a two year period. Longitudinal follow-up will provide better evidence for whether the interactions' we saw between T2D medications and traffic exposure are real.

Abstract Number	**O-1-27-01**
Presenter	Elena Colicino*, Giulia Giuliano, Melinda Power, Elissa Wilker, Pantel S. Vokonas, Avron Spiro III, Marc G Weisskopf, Joel D. Schwartz, Andrea A Baccarelli
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	cross-sectional study

Single Nucleotide Polymorphisms (SNPs) in MicroRNA Processing Genes and Susceptibility to Black Carbon Effects on Cognition in a Cohort of Older Men.

Background: Air pollution exposure has been linked with age-related loss of cognition, but pathways mediating this effect are still unclear. MicroRNAs (miRNAs) are short non-coding RNAs with key roles in gene expression and neuronal programming. MiRNA levels may vary due to single nucleotide polymorphisms (SNPs) in miRNA-processing genes. Aims: To assess whether SNPs in miRNA-processing genes modify the impact of long-term exposure to black carbon (BC), a marker of traffic air pollution, on cognitive functions of older men. Methods: 536 men (mean age 71±7 years) from the VA Normative Aging Study were tested up to 4 times (mean=1.8) between 1996-2007 for 7 tests of multiple cognitive domains. We tested statistical interactions of 18 miRNA-related SNPs with 1-year average BC level estimated before the first visit via a validated land-use regression model. Logistic regression was used for low (≤25) Mini-Mental State Examination (MMSE) and mixed-effect regression for a global cognitive score combining the 6 other tests. Results: Each doubling in BC was associated with 1.25 times higher odds (95%CI:0.98;1.59) of low MMSE score, and non-significantly lower global score (-0.02 Standard Deviation (SD); 95%CI:-0.08;0.04) adjusting for clinical and lifestyle factors. BC effect on MMSE was larger in carriers of rs11077 XPO5 variants (OR=1.59; 95%CI:1.14;2.22) and in GEMIN3 rs197388 wild-types (OR=1.39; 95%CI:1.06;1.83). BC effect on global cognition score was stronger in GEMIN3 rs197388 wild-types (-0.05SD; 95%CI:-0.12;0.01); and GEMIN4 rs4968104 (-0.08SD; 95%CI:-0.16;0.00) and GEMIN4 rs910924 (-0.07SD; 95%CI:-0.15;0.00) variant carriers. These interactions were significant at False Discovery Rate<0.20. Conclusions: Long-term effects of BC on cognition were modified by miRNA-processing SNPs. Findings on GEMIN3 and GEMIN4 genes were consistent with effect modification of BC on blood pressure (Wilker E et al, EHP 2010), thus suggesting miRNA-processing as a common pathway for BC effects.

Abstract Number	**O-1-27-02**
Presenter	Cathryn Tonne*, Alexis Elbaz, Archana Singh-Manoux
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	cohort study

Traffic related air pollution in relation to cognitive function in the Whitehall II cohort

Background Exposure to traffic related particles may have adverse effects on cognitive function; however, the epidemiological evidence remains limited. Aims We investigated whether long-term exposure to traffic related air pollution at residence was associated with cognitive function. Methods We included participants of the Whitehall II cohort who were residents of greater London at Phase 9 of the study [2007-2009], whose postcodes could be linked to modelled air pollution, and who attended the Phase 9 clinic visit (n=2867). Mean (sd) age of participants was 66 (6) years. Annual average concentrations of air pollution (NOx, PM10 and PM25, and exhaust only PM10 and PM2.5) were modelled at resolution of 20m x 20m for 2003 to 2009. We considered several exposure windows: five and three year average exposure at residence; and lagged exposure (lags 0 to 4) prior to the year cognitive function was measured. Five cognitive function tests measuring reasoning, memory, phonemic fluency, semantic fluency, and vocabulary were analysed after converting to Z-scores. Results Mean (sd) 5-year average exposure in µgm-3 was 61.0 (14.3) for NOx and 14.9 (0.9) for PM2.5. There was some evidence of an association between traffic pollution and reasoning for exposures more distant in time. An interquartile range increase (1.1 µgm-3) in PM2.5 four years prior to the clinic visit was associated with -0.05 lower reasoning (95% CI -0.09, -0.005) in the fully adjusted model. Associations were similar in magnitude for memory but not statistically significant. There was no evidence that traffic pollution was associated with lower cognitive function for the other tests. Conclusions Our data provide weak support that traffic related air pollution is associated with lower cognitive function.

Abstract Number	**O-1-27-03**
Presenter	Erin Wickerham, Debra Schaumberg, Sung Kyun Park*
Exposure	metals
Health domains	neurodegeneration
Type of research	cross-sectional study

Environmental cadmium and lead exposures and age-related macular degeneration in US adults: the National Health and Nutrition Exam Survey, 2005 to 2008

Background: Age-related macular degeneration (AMD) is the leading cause of blindness in the US. It is a complex disease resulting from the interplay of genetic predisposition and environmental exposures, and has been linked to oxidative stress and inflammatory mechanisms. Lead and cadmium can accumulate in human retinal tissues and may damage the retina through oxidative stress, and may thereby play a role in the development of AMD. Aim: To examine the associations of cadmium and lead with AMD in US adults. Methods: We analyzed data from 5,390 participants aged 40 years and older from two cycles of the National Health and Nutrition Examination Survey from 2005 to 2008. Retinal photographs were graded with a modification of the Wisconsin Age-Related Maculopathy Grading System to identify signs of any AMD including both early and late AMD. Results: The weighted prevalence of AMD was 6.6% (n=426) and the geometric mean blood lead, blood cadmium, and urinary cadmium levels were 1.65 (95% confidence interval (CI), 1.60-1.71) µg/dL, 0.41 (0.39-0.42) µg/L, and 0.29 (0.27-0.31) µg/L, respectively. After controlling for age (linear and quadratic), gender, race/ethnicity, education and body mass index (<25, 25-29.9, 30+ kg/m2), those in the highest blood cadmium quartile had a higher odds of AMD compared to the lowest quartile (odds ratio (OR)=1.56, 95% confidence interval (CI): 1.02, 2.40), with a significant trend across quartiles (p for trend=0.02). After further adjustment for pack-years of cigarette smoking, these estimates were somewhat attenuated (OR=1.43; 95% CI: 0.91, 2.27; p for trend=0.08). There was a suggestive association between urinary cadmium and AMD (OR comparing the highest with the lowest quartiles of urinary cadmium=2.18; 95% CI: 0.70, 6.83; P for trend=0.09). We found no association between blood lead and AMD. Conclusion: Higher cadmium body burden may increase risk of AMD. Additional studies are needed to confirm the association between cadmium and AMD.

Abstract Number	**O-1-27-04**
Presenter	Jason Curran*, Christopher Carlsten
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	case-crossover study

Effects of acute diesel exhaust exposure on brain health: a controlled, blinded crossover study

Background: Although the effects of prolonged exposure to traffic-related air pollution are well-characterized with respect to respiratory and cardiovascular outcomes, comparatively little is known about the impact of particulate matter on affective, cognitive, and neurodegenerative effects, particularly after short-term exposures.Aims: To establish that acute inhalation of moderate-dose diesel exhaust, typical of occupational or high-ambient concentrations, alters cognitive function in humans through an in vivo, controlled crossover experiment.Methods: We recruited 10 healthy adult subjects and exposed them to two exposure conditions: filtered air and carefully controlled levels of diesel exhaust (300µg PM2.5/m3) for 120 minutes. Prior to and following each blinded condition we measured cognitive outcomes including reaction time, working memory, attention-switching, and executive function tasks using the Cambridge Neuropsychological Test Automated Battery (CANTAB). As well, using functional magnetic resonance imaging (fMRI), we assessed changes in the network of active brain regions attributable to diesel exhaust inhalation and characterized changes in those regions specifically associated with a task of working memory. An array of peripheral blood markers related to neurodegenerative processes were also collected and analyzed at selected time points pre- and post-exposure. Each exposure condition was separated by a 4-week washout period. Repeated measures ANOVA was used to evaluate the main effects of exposure on changes in cognitive endpoints.Results: Preliminary data demonstrates impairment, 1-hour following diesel exhaust exposure, in reaction time (4% [Δ20.3 ms] mean decrease post-DE exposure) and attention-switching (an executive function task). Changes return to baseline over the subsequent 24 hours, post-diesel exhaust exposure.Conclusion: Exposure to acute diesel exhaust exposure may have a deleterious effect on a variety of cognitive endpoints in healthy adult subjects.

Abstract Number	**O-1-27-05**
Presenter	Natalia Palacios*, Kathryn Fitzgerald, Jaime E. Hart, Kassandra Munger, Ascherio Alberto, Laden Francine
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	cohort study

Particulate matter air pollution and risk of Multiple Sclerosis in a large study of female nurses.

Background: Multiple Sclerosis (MS) is a common autoimmune disorder of the nervous system of unknown origin. The incidence of MS is increasing throughout the world, but the specific reason for this increase has not been identified. Cigarette smoking, whose effects on the immune and nervous system are thought to be similar to air pollution, has consistently been associated with increased MS risk, as well as worse progression of MS. Aims: In this study, we used data from a large prospective study on US women to examine whether there is an association between particulate matter (PM) air pollution and risk of MS. Methods: This study included participants from an ongoing prospective cohort study, the Nurses' Health Study II (NHS II). Cumulative average exposure to different size fractions of PM up to the time of MS onset, was estimated using a spatio-temporal model by linking each individual's places of residence throughout the study with location-specific air pollution levels. We used multivariable Cox proportional hazards models to estimate the risk of MS associated with PM10, PM2.5 and PM10-2.5, adjusting for smoking, body mass index at age 18, ethnicity, population density, region, season, birth tier, income and housing value. Results: Overall, we found no significant associations between PM2.5, PM10-2.5, or PM10 exposure and MS risk. The RR comparing the top quintile to the bottom quintile of exposure was 1.30 (95% CI: 0.84, 2.01), 0.94 (95% CI: 0.65, 1.37) and 1.13 (95% CI: 0.76, 1.65) for PM10, PM2.5 and PM10-25, respectively. In sensitivity analyses among never smokers, we did not find significant associations for any of the exposures of interest. Conclusions: In this study, we did not find convincing evidence that exposure to air pollution during adulthood is a risk factor for MS.

Abstract Number	**O-1-27-06**
Presenter	Muhammad Farid Abdul-Rahman, Kathryn Taylor*, Melissa Perry, Marie-Helene Saint-Hilaire, Lewis Sudarsky, David K. Simon, Bonnie Hersh, Howard Hu, Marc G Weisskopf
Exposure	pesticides
Health domains	neurodegeneration
Type of research	case-control study

Home use of Pesticides and Risk of Parkinson's Disease

Background: Pesticide use has been consistently associated with the risk of Parkinson's disease (PD). While household use of pesticides is widespread, the contribution of household pesticide use to PD is not well understood. This may be in part because of the difficulty of exposure assessment given that the general public is not typically aware of specific pesticides used in the home. Aims: To investigate the association between household pesticide use and PD by asking study participants to identify use by intended target rather than specific compound. Methods: We obtained home pesticide use data from 227 PD patients, recruited from four movement disorder clinics in the Boston, Massachusetts area, and 236 controls. Pesticide use, and the years of such use, was queried by questionnaire and was asked based on intended targets not specific compounds. We conducted logistic regression analyses adjusting for age, sex, smoking, and education to estimate odds ratios (OR) and 95% confidence intervals (CI). Results: Possible occupational use of pesticides was reported by 89 subjects, and the OR for PD by such use was 1.624 (95% CI: 0.99-2.70). After excluding these participants, home use of pesticides targeting garden, flower or tree fungicides (OR=2.00; 95% CI: 1.25-3.22; p=0.004), mosquitoes (OR=1.48; 95% CI: 0.94-2.31; p=0.09), general insecticide indoor spraying (OR=0.64; CI: 0.39-1.05; p=0.07) and clothes moths or silverfish (OR=0.58; CI: 0.39-0.88; p=0.01) had suggestive associations with PD. In sensitivity analysis that only considered exposure more than 10, 15, and 20 years before the questionnaire, only the OR for garden, flower or tree fungicides (OR=2.58, CI: 1.44-4.63, p=0.001) remained suggestive even considering exposure only 20 years earlier. Conclusion: Our results suggest that home use of certain pesticides increases the risk of PD. Assessing exposure based on intended targets may facilitate assessment of home pesticide exposures.

Abstract Number	**O-1-28-01**
Presenter	Anne Oppliger*, Philippe Moreillon, Marlyse Giddey, Nicole Charrière, Delphine Morisset, Olga Sakwinska
Exposure	microbial environment
Health domains	infectious diseases
Type of research	occupational study

Farmers acquire antimicrobial resistant Staphylococcus aureus from pigs

Carriage of animal-associated MRSA CC398 is common among pig farmers. This study was conducted to investigate: 1) whether pig farmers are colonized with pig-specific S. aureus genotypes different than CC398, and 2) survey antimicrobial resistance of S. aureus isolates from pigs and pig farmers. Forty-eight S. aureus isolates from pig farmers and veterinarians and 130 isolates from pigs collected in Western Switzerland were genotyped by spa-typing and amplified fragment length polymorphism (AFLP). Antimicrobial resistance profiles were determined for representative sample of the isolates. Obtained earlier data on healthy S. aureus carriers without exposure to agriculture were used for comparison. The genotype composition of S. aureus isolates from pig farmers and veterinarians was similar to isolates from pigs with predominant AFLP Clusters CC398, CC9 and CC49. The resistance to tetracycline and macrolides was common among the isolates from farmers and veterinarians: 52% isolates were resistant to tetracycline and 21% to clarithromycin. The resistance levels among isolates from pigs were very similar: 39% resistant to tetracycline and 23% resistant to clarithromycin. This was in contrast to isolates from persons without contact with agriculture, where no (0/128) isolates were resistant to tetracycline and 3% of isolates were resistant to clarithromycin. MRSA CC398 was isolated from pigs (n=11) and pig farmers (n=5). These data imply that zoonotic transmission of multidrug resistant S. aureus from pigs to farmers is very frequent, and well-known MRSA transmission merely represents a tip of an iceberg of this phenomenon. We speculate that relatively low frequency of MRSA isolation is related to lower antimicrobial use in Switzerland compared to e.g. the Netherlands.

Abstract Number	**O-1-28-02**
Presenter	Richard Shaughnessy*, Eugene Cole, Demetrios Moschandreas, Ulla Haverinen-Shaughnessy
Exposure	microbial environment
Health domains	infectious diseases
Type of research	health impact assessment

Effectiveness of Cleaning of Residual Contamination on High-Contact Surfaces and Relationship to Health of Students in Schools

BACKGROUND: Recent studies indicate that enhanced hygiene in schools and targeted cleaning of biological residual contamination, related to frequent-contact points, result in reduced illness. Previously, we have published “typical ranges” of biologically-derived surface contamination in 27 schools from the Southwestern region of the United States, using adenosine triphosphate (ATP) as a marker for measurement of cleaning effectiveness. AIMS: · To assess the applicability of the previously compiled database of “typical” ranges of surface contamination levels (based on ATP measurements) in schools, as to its usefulness in other geographic and climatic regions in the USA. · To conduct preliminary analyses on a previously compiled database from 27 schools related to potential associations between ATP levels and health symptoms of students. METHODS: A sample of elementary schools from four regions of the USA (N=20) were utilized to collect >3900 ATP samples from high-contact touch surfaces in classrooms, bathrooms, and cafeterias. In addition, previously collected data (school nurses’ health data, student background, and surface ATP readings) were merged and analyzed. RESULTS AND CONCLUSIONS: The newly acquired data from four regions aligned well with the original dataset. These data may serve as the basis for a standard approach to the measurement of cleaning effectiveness in schools predicated on “typical” ranges of ATP levels of surface residual contamination. Preliminary analyses indicated statistically significant associations between health symptoms (gastrointestinal, abdominal pain, sore throat, respiratory, and headache) and ATP levels. However, a larger sample size may be needed for more definite conclusions.

Abstract Number	**O-1-28-03**
Presenter	Eric Kettleson*, Kanistha Chatterjee, Chris Schaffer, Atin Adhikari, Sergey Grinshpun, Stephen Vesper, Tiina Reponen
Exposure	microbial environment
Health domains	no health domain
Type of research	exposure measurement

Use of pyrosequencing to assess bacterial diversity in green-renovated buildings

Background: Green renovation is designed to improve the energy efficiency and indoor air quality of a building by modifying physical attributes of the structure. These changes can affect ventilation rates and moisture levels which could, in turn, have an effect on the indoor environmental microbiome. Aims: Investigate how bacterial diversity differs between green-renovated and non-renovated reference residential buildings using pyrosequencing. Methods: House dust was collected by floor vacuuming from the living room of 20 apartments before and after green-renovation. DNA extracts from the dust underwent 454 pyrosequencing using the 28F-519R bacterial assay which covers the variable regions V1-V3 on the 16s rRNA gene. Sequence files were queried against a database of high quality bacterial sequences with a BLASTN+ search program and classified at the appropriate taxonomic levels based on identity scores. Results: In non-renovated apartments, the three most abundant phyla in the dust were Proteobacteria, Actinobacteria, and Firmicutes at 39%, 26%, and 20% of the operational taxonomic units (OTUs) observed, respectively. In renovated apartments, the Firmicutes relative abundance increased to 28% of the OTUs (p=0.012), which was offset by decreases in the Proteobacteria and Actinobacteria proportions. The increase in the Firmicutes abundance was driven primarily by increases in the Streptococcus (p=0.001), Lactococcus (p=0.025), and Lactobacillus (p=0.027) genera. Conclusions:These three genera are representative of bacteria that are part of the commensal human microbiome. Renovation activities appear to permit human-related bacteria to initially account for a larger proportion of the overall bacterial composition compared to the non-renovated condition. The data generated in this pilot study provide a baseline measure of bacterial diversity useful in a longitudinal study investigating the change of indoor bacterial diversity following green renovation.

Abstract Number	**O-1-28-04**
Presenter	Stéphane Moularat, Marjorie Draghi*, Rukshala Anton, Enric Robine
Exposure	microbial environment
Health domains	no health domain
Type of research	others

Volatil organic compounds : a way to detect fungal development in indoor environments

Background : Fungi are common biocontaminants in closed environments able to induce respiratory diseases and degradation of substrates they colonize.However, as soon as they start to grow, fungi emit VOCs which arise from their metabolism or from the degradation of materials. Unlike spores, VOCs are dispersed in the environment and are not retained by substrates. Consequently, measuring these specific compounds should enable both the detection of early and hidden proliferations. However, until now, the use of VOCs as a fungal tracer has been limited by their low levels compared with those from materials and also by the lack of specificity of most of the VOCs emitted. Aims :The aim of this study consists on determining if there are specific chemical emissions of fungal growth. To achieve this, chemical emissions from sterile products and those contaminated artificially by molds were analyzed using a descriptive statistical method. Methods :Three fungal strains frequently isolated in indoor environments were employed.Two types of products were used as growth substrates: a control substrate consists on fiberglass and five commercial materials frequently encountered in indoor environments. The VOC are sampled on adsorbent tube and analyzed by GC/MS. Results : The statistical analysis used, Principal Component Analysis, considers the chromatograms of each type of substrate without prejudging compounds. This analysis, applied to each product's emissions, enabled to differentiate contaminated substrates from sterile ones. Furthermore comparison of ion fragments from chemical emissions between contaminated and sterile products enabled to determinate 59 ion fragments responsible of the discrimination.This VOC fingerprint of fungal growth has been tested on samples from 12 dwellings and permitted to detect the 7 contaminated ones. Conclusions :Despite the low emission rates, this study proves that the emission of specific VOC enables to detect the presence of an active fungal development in indoor environments even in the case of hidden contamination.

Abstract Number	**O-1-28-05**
Presenter	Hal Levin*
Exposure	microbial environment
Health domains	other
Type of research	others

Interactions between indoor environmental conditions and indoor microbial ecology: Literature review and database development

Background: Microbial communities found indoors are of substantial health and environmental significance. Genetic sequencing methods have increased the number of identified microbes by a factor of 10 in the past two decades. The community composition can vary in response to geographical location, season, temperature, available nutrients, moisture, surface materials, pH, and other factors. Microbial ecologists often characterize microbial communities indoors without sufficient focus on the environmental conditions that favor the occurrence, survival, reproduction, and toxicity or pathogenicity of organisms of interest. Characterization of the microbial ecology of the indoor environment can be enhanced research that characterizes key factors associated with specific organisms. Aims: Ascertain key environmental variables relevant to characterization of indoor microbial communities and their composition. Provide guidance to researchers, the building community, and public health officials on environmental factors relevant to occurrence and control to minimize risks of exposure to health-relevant organisms. Methods: A selective literature review was performed and the results used to create database of >300 articles. The database enables identification of dominant patterns of associations between environmental factors and organisms. Results: Organism-specific factors are identified and key factors are reported with emphasis on indoor environmental characteristics most commonly associated with specific organisms. Conclusions: The reviewed literature is broad, often lacking relevant detail on environmental conditions. Analysis of the literature to identify environmental factors relevant to organism occurrence, survival, and virulence provides information that can inform researchers as well as public health officials regarding the conditions most favorable for specific organisms. The database is available on the microbe.net web site.

Abstract Number	**O-1-28-06**
Presenter	Shengjie Lai*, Zhongjie Li, Honglong Zhang, Dan Zhao, Dinglun Zhou, Yajia Lan, David Buckeridge, Archie Clements, Wenbiao Hu, Weizhong Yang
Exposure	microbial environment
Health domains	infectious diseases
Type of research	cross-sectional study

An early warning and response system for hand, foot and mouth Disease in China, 2011-2012

Background: A China Infectious Disease Automated-alert and Response System (CIDARS) has been increasingly utilized nationwide for early outbreak detection and rapid response for infectious diseases in China. Hand, foot and mouth disease (HFMD) is a common childhood illness caused by enterovirus. Over the last two years, over 3.79 million HFMD cases with clinical diagnosis have been reported in China. Aims: This study aims to evaluate the performance of CIDARS for HFMD outbreak detection, and determine whether CIDARS can act as a good tool to detect the outbreaks of HFMD in China. Methods: A cross-sectional study on case-based and event-based HFMD surveillance systems was conducted. The detection timeliness and the size of HFMD outbreak was compared before and after CIDARS was used. The sensitivity and timeliness of detection of CIDARS were investigated. Results: 106,005 signals of HFMD among 2,608 counties were generated by CIDARS from May 2010 to April 2012, with an average of 5.6 signals per 100 days in each county. 98.6% signals were responded by local public health institutes, and 90.78% of them were responded in 24 hours. 574 outbreaks were detected in CIDARS, with the sensitivity of detecting all reported outbreaks was 92.73%, and the average time to detection outbreak were 2.1 days. With CIDARS support, the magnitude of HFMD outbreak was smaller and reporting timeliness was better than that of without CIDARS support. Conclusions: Our study showed that CIDARS had a good sensitivity and timeliness for HFMD outbreaks detection.The early warning system could benefit to HFMD outbreak report at early stage and facilitate rapid response. Keywords: Hand, foot and mouth disease; Outbreak; Early detection; Evaluation

Abstract Number	**O-1-31-01**
Presenter	Elaina MacIntyre, Elaine Fuertes*, Anna Mölter, Ulrike Gehring, Claudia Klümper, Olena Gruzieva, Mireia Gascón, Daniela Porta, Göran Pershagen, Joachim Heinrich
Exposure	ambient air pollution
Health domains	infectious diseases
Type of research	meta-analysis

Traffic-related air pollution and respiratory infections during early childhood: an analysis of seven European birth cohorts within the ESCAPE project

Background: Few studies have investigated traffic-related air pollution as a risk factor for respiratory infections during early childhood. Aim: To examine the association between air pollution and respiratory infection in 7 European birth cohorts - BAMSE (Sweden), GASPII (Italy), GINI/LISA (Germany), INMA (Spain), MAAS (UK) and PIAMA (The Netherlands) - and to calculate combined effect estimates using meta-analyses. Method: Parent report of physician diagnosed respiratory infection during early childhood were assessed in relation to annual average pollutant levels (NO2, NOx, PM2.5, PM2.5 absorbance, PM10, Coarse PM) estimated using land use regression models and assigned to children based on their birth address. Identical protocols were used to assess exposure for each study as part of ESCAPE. Logistic regression was used to calculate adjusted effect estimates for each study and random-effects meta-analysis was used to calculate combined estimates. Results: For pneumonia, combined estimates were consistently elevated and statistically significant (aOR:1.31(95%CI:1.06-1.63) per 10µg/m³ increase in NO2;1.76(1.00-3.09) per 10µg/m³ increase in PM10). For otitis media and croup, results were null across all analyses except for NO2 and otitis media (1.09(1.02-1.16) per 10µg/m³ increase). Air pollution effects were generally greater during the first year of life compared to the second (1.19(1.07-1.33) versus 1.07(0.96-1.20) per 10µg/m³ increase in NO2 for otitis media; 1.77(1.18-2.67) versus 1.42(0.99-2.03) per 10µg/m³ increase in PM10 for pneumonia). Sensitivity analyses using back-extrapolated data were consistent with overall findings. Conclusion: Our meta-analysis of 7 European birth cohorts within the ESCAPE project found strong evidence for an association between traffic-related air pollution and pneumonia in early childhood and inconsistent evidence for an association with otitis media. Policies that reduce traffic-related air pollution may also reduce the burden of pneumonia in early childhood.

Abstract Number	**O-1-31-02**
Presenter	Paul Fischer*, Marten Marra, Nicole Janssen, Guus Velders, Caroline Ameling, Wim Swart, Gerard Hoek, Kees de Hoogh, Oscar Breugelmans, Hanneke Kruize, Danny Houthuijs
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Air pollution and all-cause mortality in the Netherlands

Background: Health effects of (particulate) air pollution are well-known and have a large impact on the burden of disease from environmental factors. While effects from exposure to short-time variations in air pollution levels are documented extensively, there is a scientific need for studies that add to our knowledge on health effects from long-term exposure. Aims: To assess the association between chronic exposure to air pollution and mortality using a national cohort consisting of all 7 million Dutch addresses (15.5 million inhabitants on 1 January 2004) with individual mortality and confounder information. Methods: We linked air pollution data to mortality data for 7,014,082 unique addresses. Exposure data were based on two different data sources: PM10 and NO2 data were calculated based on LUR-models for 2001 and PM10, PM2.5, NO2 data were calculated based on dispersion models for 2009. Baseline confounder statistics on age, gender, marital status, country of origin and standardised household income for the year 2001 were obtained from Statistics Netherlands for all inhabitants of age over 20 who had not changed address in the previous 5 years (~ 8 million inhabitants). Mortality data for a follow-up period of 7 years were regressed on air pollution estimates, adjusted for confounders at the individual level using Cox'proportional hazard models. Results: All exposure measures were statistically significant associated with total mortality and were, adjusted for IQR, of the same magnitude. Hazard Rates per 10 ug/m3 increase were 1.10 (LUR), 1.14 for PM10, 1.16 for PM2.5 and 1.05 (LUR), 1.04 for NO2. Conclusion: Our results confirm earlier observations that chronic exposure to (traffic- related) air pollution, indicated by PM10, PM2.5 or NO2, is associated with total mortality. The study-design assures sufficient statistical power to further elaborate sub-group cause-specific mortality, morbidity and component-specific air pollution relationships. Latest developments on the data-analysis will be presented at the meeting.

Abstract Number	**O-1-31-03**
Presenter	Hong Chen*, Richard T. Burnett, Jeffrey Kwong, Paul J Villeneuve, Mark Goldberg, Robert Brook, Aaron van Donkelaar, Michael Jerrett, Randall V. Martin, Jeffrey Brook, Ray Copes
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Incidence of Hypertension and Subsequent Mortality in Relation to Chronic Exposure to Fine Particulate Matter

Background: Long-term exposure to PM2.5 may be associated with the development of hypertension and thus it is possible that persons with hypertension may be at increased risks for subsequent mortality. Methods: To answer this question, we assembled a cohort of 35,303 non-hypertensive adults who lived in Ontario, Canada, and who completed one of four population-based health surveys between 1996 and 2005. Incident diagnoses of hypertension were ascertained from the Ontario Hypertension Database, a validated registry (sensitivity=73% and specificity=95%). Long-term annual mean concentrations of PM2.5 at the subjects' residences were derived from satellite observations. We assessed the association between long-term exposure to PM2.5 and incident hypertension using Cox proportional hazards models, while adjusting for various individual and contextual risk factors such as body mass index, smoking, physical activity, and neighbourhood income To examine whether hypertension may modify the risk of mortality in association with PM2.5, we fitted a different Cox model using mortality as the event and we tested for interaction between time-dependent hypertension and PM2.5. We conducted various sensitivity analyses to assess the robustness of the effect estimates, including, assessing the impact of residential mobility on the effect estimates and additionally adjusting for proximity to major roads. Results:Between 1996 and 2010, we identified 8,649 incident cases of hypertension. For every 10µg/m3 increase of PM2.5, the adjusted hazard ratio of incident hypertension was 1.13 (95% confidence interval (CI): 1.05-1.22). The test for interaction between hypertension and PM2.5 was statistically significant and we found a stronger association of mortality with PM2.5 among hypertensive individuals. The estimates of association were virtually unchanged in our sensitivity analyses. Conclusions: This study supports a possible relationship between PM2.5 and hypertension. Our results also suggest that hypertension may modify the effect of PM2.5 on mortality.

Abstract Number	**O-1-31-04**
Presenter	Massimo Stafoggia*, Giulia Cesaroni, Annette Peters, Francesco Forastiere, Cardiovascular working group Escape
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term exposure to ambient air pollution and incidence of cerebrovascular events – Results from eleven European cohorts within the ESCAPE Project

Background. Chronic effects of air pollution on mortality have been documented, but little is known about the long-term effects of air pollution on the incidence of cerebrovascular events. Aim. To estimate the association between long-term exposure to ambient particulate matter (PM) and nitrogen oxides (NOx), and the incidence of stroke in European prospective cohorts. Methods. Individual data from 11 cohorts were collected. Subjects with a pre-existing coronary or stroke event were excluded. Residential addresses of all subjects were geocoded, and air pollution exposures were predicted from land-use regression models developed within the “European Study of Cohorts for Air Pollution Effects” (ESCAPE) project (www.escapeproject.eu). Air pollution exposures were: PM2.5 (PM below 2.5 µm), coarse PM (PM between 2.5 and 10 µm), PM10 (PM below 10 µm), PM2.5 absorbance, and nitrogen oxides. Traffic variables were also evaluated. The main outcome measure was the occurrence of a first stroke based on medical records, mortality registries or hospital discharge databases. Cox proportional hazards models were fit within each cohort, followed by meta-analysis. Results. 99,446 subjects were included, developing 3,086 incident cases of stroke. Overall, a 5-µg/m3 increase in annual PM2.5 exposure was associated with 19% increased risk of incident stroke (hazard ratio [HR]=1.19, 95% confidence interval [CI], 0.88 to 1.62). Similar findings were obtained for PM10. The results were robust to adjustment for an extensive list of cardiovascular risk factors. The effect of PM2.5 was large and statistically significant among never smokers (HR=1.74, 95% CI, 1.06 to 2.88), and among subjects below the current Limit Value for mean annual PM2.5 concentration in Europe, i.e. 25 µg/m3 (HR=1.33, 95% CI, 1.01 to 1.77). Conclusions. We found suggestive evidence of an association between long-term exposure to fine particles and the incidence of stroke in Europe, even at concentrations below the current air quality Limit Value.

Abstract Number	**O-1-31-05**
Presenter	Carla Ancona*, Chiara Badaloni, Francesca Mataloni, Andrea Bolignano, Simone Bucci, Giulia Cesaroni, Marina Davoli, Roberto Sozzi, Francesco Forastiere
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Mortality and morbidity in a population exposed to multiple sources of air pollution in Rome

Background and Aims: In the area of Malagrotta, Rome (Italy), a large waste landfill, an incinerator, and an oil refinery plant have been operating since the early 1960s. To evaluate the health effects due to airborne contamination, a retrospective cohort study was performed using GIS and dispersion modelling for exposure assessment. Methods: The study area was defined as the 7 km zone around the landfill. The cohort is based on the 2001 census, with a mortality and hospitalization follow-up until 2010. For each cohort member, individual (education, occupation, place of birth, civil status, area-based SES) and GIS variables (distance from motorways and from high traffic roads) were available. Exposure assessment to the incinerator (PM10), the refinery plant (SOx) and the landfill (H2S, indicator of diffuse emissions) was done with the SPRAY Lagrangian dispersion model. Cox regression analysis was used considering individual and GIS variables. Results: The cohort included 85,559 individuals and for all subjects the level of the three pollutants was estimated at the baseline residential address. The estimated annual average exposures to H2S, SOx, and PM10 were rather low and the exposure indicators were highly correlated. The most convincing association was of PM10 levels with respiratory mortality (HR 1.82 CI 95% 1.16-2.81 comparing high vs low PM10 concentration area) and morbidity (HR 1.33 CI, 1.19-1.50) among men. We also observed some relationships with cancer sites: H2S levels with larynx and bladder cancer (both mortality and hospitalizations), SOX levels with larynx and bladder cancer, PM10 levels with pancreatic (men) and larynx, live, and bladder cancer (women). Conclusions: We found, in this cohort, increased risk for respiratory diseases and some cancer forms. However, it is difficult to assess the emissions (and consequently the plants) most responsible for the observed effects.

Abstract Number	**O-1-31-06**
Presenter	Ryan Shanley*, Richard Hayes, George Thurston, Kevin Cromar, Yongzhao Shao, Yikyung Park, Jiyoung Ahn
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cohort study

Interaction between long-term PM2.5 exposure and smoking status on mortality risk in the NIH-AARP Diet and Health Cohort

BACKGROUND: Smoking status has been shown to modify the association of fine particulate matter (PM2.5) and mortality. However, mortality estimates of air quality improvements have generally not taken into account the risks of PM2.5 exposure according to smoking status. AIMS:We tested the hypothesis that the associations of long-term PM2.5 exposure and risk of mortality differ by smoking status and estimated absolute PM2.5-mortality risks by smoking status. METHODS: 479,044 adults in the NIH-AARP Diet and Health Cohort were followed from 2000-2006. 50,630 deaths occurred during the follow-up. Time-dependent PM2.5 exposures were estimated by kriging interpolation of PM2.5 monitoring data. Multivariate Cox proportional hazards models were used to estimate relative risks (RRs) and 95% confidence intervals (CIs). Absolute mortality risks by smoking status were estimated using incidence rates from the NIH-AARP cohort and national smoking rates from Center for Disease Control. RESULTS: A 10 µg/m3 increase in PM2.5 was associated with an overall 6.3 % increased risk for mortality (RR [95%CI]=1.066 [1.028-1.106]). The relationship of PM2.5 with mortality was most pronounced in never smokers (1.141 [1.057-1.232]) as compared to former smokers (1.067 [1.014-1.122]) and current smokers (1.008 [0.927-1.096]; p for interaction=0.014). Using these relative risks in conjunction with current smoking rates in the US, it is estimated that approximately 67%, 32%, and 1% of avoided mortalities due to reductions in ambient PM2.5 occur among never, former, and current smokers, respectively. CONCLUSIONS: Despite a lower incidence rate of mortality, never smokers experience a higher absolute risk of mortality due to long-term PM2.5 exposure as compared to former and current smokers. Due to high variability in smoking rates within the US, future health impact analysis of air quality interventions may be improved through consideration of smoking status in modifying PM2.5-mortality risks.

Abstract Number	**O-1-34-01**
Presenter	Jer-Pei Fong*, Fang-Jin Lee, I-Syuan Lu, Shi-Nian Uang, Ching-Chang Lee
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	occupational study

Relationship between Urinary Concentrations of Di (2-ethylhexyl) Phthalate (DEHP) Metabolites and Sex Steroid Hormones in PVC Operation Workers

Background: Few studies reported the urinary concentrations of phthalate metabolites in flexible plastic industry workers were significantly higher than general population. However, little is known about the disruption of reproductive hormones for those workers. Aims: We assessed the relationships between urinary metabolites of di (2-ethylhexyl) phthalate (DEHP) and reproductive hormones among the polyvinyl chloride (PVC) operation workers. Methods: A cross-sectional study of 84 male workers was conducted through the measurement of biomarkers of exposure to DEHP and steroid hormones. Relationships between urinary concentrations of DEHP metabolites and reproductive hormones were assessed using multivariable linear regression and quartile analysis models. Results: Median concentrations with urinary creatinine-adjusted (µg /g creatinine) of mono(2-ethylhexyl) phthalate (MEHP), (Mono(2-ethyl-5-oxohexyl) phthalate (MEOHP) and Mono(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP) during the post-shift period were 24.7, 65.2, and 80.0, respectively. In multiple regression models adjusted for potential confounders, there were significant positive associations between urinary concentrations of DEHP metabolites and estradiol (P <0.01), and the ratio of estradiol to testosterone (P <0.01) for PVC operation workers. Furthermore, quartile analysis also showed the significant positive relationships with total urinary concentration of DEHP metabolites and estradiol (P-value for trend = 0.008), and the ratio of estradiol to testosterone (P -value for trend = 0.029). These results indicated the potential effect of an increase in aromatase activity with DEHP exposed was occurred. Conclusions: We observed a significant positive relationship between estradiol and total urinary concentration of DEHP metabolites in PVC operation workers.

Abstract Number	**O-1-34-02**
Presenter	Su Ryeon Noh*, Jung Ah Kim, Gwi Heum Eom, Yong Jin Jeon, Hyun Sook Bae, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	biomarker
Health domains	other
Type of research	cohort study

Exposure to Spilled Oil Constituents and Oxidative Stress in Inhabitants 1.5 years After the Hebei Spirit Oil Spill

Background: The sinking of the oil tanker Hebei Spirit in December 2007 resulted in the spill of 12,547 kl of crude oil. The constituents mainly contained various volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. These compounds may cause oxidative stress. Aims: To evaluate the relationship between the levels of biological exposure markers and oxidative stress markers in residents living the affected area 1.5 years after the Hebei Spirit oil spill. Methods: Urinary metabolite of VOCs, trans,trans-muconic acid (t,t-MA), urinary metabolites of PAHs, 1-hydroxypyrene (1-OHP) and 2-naphthol, and blood and urinary heavy metals, blood lead, blood manganese, urinary cadmium, and urinary mercury were measured from 1,278 residents as biomarkers of spilled oil exposure. Urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG) and urinary malondialdehyde (MDA) levels were analyzed in 789 residents as indicators of oxidative stress. Results: The urinary metabolites of PAHs, 1-OHP and 2-naphthol significantly increased as the distance from the oil spill site to the residence was closer. The concentrations of heavy metals in the body, especially cadmium and lead, consistently showed a positive relation with the number of days of clean-up activity participation in an immediate post-spill, total number of days of clean-up work in a prolonged period, distance from the early contaminated coastline to the residence, and distance from the oil spill point ton the residence. The levels of urinary PAHs and heavy metals in urine and blood were significantly related to the oxidative stress markers including 8-OhdG and MDA. Conclusions: The concentration of PAHs metabolites and heavy metals in the body showed a positive relation to the levels of oxidative stress biomarkers even 1.5 years after the accident. The mid- and long-term adverse health effects due to the oil spill exposure are a concern in inhabitants.

Abstract Number	**O-1-34-03**
Presenter	Shelley Ehrlich*, Olivier Humblet, Thomas J. Smith, Russ Hauser
Exposure	biomarker
Health domains	other
Type of research	others

Thermal receipt handling: an unrecognized source of dermal exposure to bisphenol A – a simulation crossover study

Background: Human exposure to bisphenol A (BPA) is widespread and of high public health concern due to associations with adverse health outcomes. Exposure is primarily through diet and consumption of canned foods. A less well recognized source of exposure to BPA is thermal receipt handling. We hypothesized thermal receipt handling significantly increases BPA exposure via the dermal route. Methods:We recruited 24 volunteers for a simulation crossover study. Participants printed and handled receipts for 2 consecutive hours without the use of dermal protection (no gloves) in the first simulation. This was then repeated using nitrile gloves after a washout period of at least one week. Two urine samples were collected: one immediately prior to each simulation, another 2 hours after completing the simulation. The urine specific gravity (SG) was measured using a handheld refractometer; total urinary BPA concentration was measured at the Centers for Disease Control and Prevention using online solid-phase extraction coupled to isotope dilution high-performance liquid chromatography–tandem mass spectrometry.We used paired t-tests to examine mean change in log-transformed SG-adjusted urinary BPA concentrations between timepoints. Results: SG-adjusted geometric mean urine concentration of BPA increased from 2.0 µg/L pre-simulation to 6.0 µg/L (95% CI, 4.2-8.5 µg/L) post-simulation (P =0.0012). There was no significant increase in urine BPA after handling receipts with gloves. Eleven participants provided sequential urine samples over 24 hours where SG-adjusted geometric mean urine BPA concentrations reached a peak of 11.1µg/L at 8h. Conclusion: Three and 5-fold increases in geometric mean urinary BPA concentrations were observed at 4 and 8 hours after receipt handling began. There was no significant increase in urinary BPA when the simulation was repeated with gloves. These findings suggest receipt handling is a significant source of exposure to BPA through the dermal route.

Abstract Number	**O-1-34-04**
Presenter	Ivy Shiue*
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

The role of housing characteristics in biomarkers: US NHANES

BackgroundHousing inequality may pose a significant social problem in the society. There are numerous studies investigating the effect of housing on illness and human health, in particular in children. However, relationships with specific biomarkers are less examined. AimsIt was aimed to study the relationships of housing characteristics (including home type, house age, and so on) and biomarkers (including serum and urine measurements such as blood pressure, vitamin D, chemicals, and so forth) in a national and population-based study. MethodsData were retrived from United States National Health and Nutrition Examination Surveys, 2005-2006, including demographics, biomarkers measurements, and environmental chemicals. Participants were grouped into children and adults. Analyses included t-test, chi-square test, generliased linear model, and logistic regression modelling. All models were survery weighted as well. ResultsAfter adjusting for age, sex, ethnicity, poverty income index, and survey weighting, it was observed that house age was inversely associated with vitamin D levels (Beta 0.01, 95%CI 0.0003-0.02, P=0.049). Similarly, there's relation between home types and vitamin D levels. Likely, dorms an apartments less receive vitamin D for residents, compared to houses, terraces, or others. There are other examinations with similar findings while some showed no association such as total serum IgE levels. ConclusionsAssociations between housing characteristics and biomarkers have existed. Housing inequality could potentially increase health and social inequalities leading to adverse health outcomes later in life. Future research with longitudinal design is needed to confirm the observations and public health programs may need to target this less concerned area for public welfare.

Abstract Number	**O-1-34-05**
Presenter	Randi Bertelsen*, Wael Al-Delaimy
Exposure	biomarker
Health domains	ethics
Type of research	review

Ethical challenges in reporting biomonitoring results in environmental epidemiology (e*)

Human biomonitoring is an important tool for exposure assessments in environmental epidemiology. The primary goal of environmental epidemiology research is to improve the health and welfare of the population by identifying the magnitude of environmental exposures that are suspected of being harmful to health. Measuring biomarkers of exposure in biological specimens raises important ethical issues at the individual level even though the purported intent is to protect individuals from possible harms. A common topic is whether study participants should be given feedback on their biomarker levels. The laboratory methods are evolving to measure body burden of exposure to both emerging as well as established chemicals. Some chemicals are “active” ingredients in consumer products, but others are ubiquitous in our environment, with numerous sources that are almost impossible to identify. Biomarkers help us identify the overall exposure regardless of the source, which is a major advantage over environmental or self-report methods. However, most of these biomarkers have not been validated in the population and thresholds for risks have not been identified. Feedback of individual or group level exposure based on biomarkers may therefore lead to unnecessary concerns and harm the study participants. Study limitations, available evidence of negative health impact, knowledge of the level of exposure in comparable populations, and known sources of exposure with proper prevention strategies, are areas that may need to be considered before deciding to provide feedback on biomarker levels to study participants or not. Harm vs benefit should be assessed on a case by case approach. We need to consider how we communicate results when we have little knowledge on health effects and sources of exposure. We will address these matters in a designated ethics discussion session on ethical challenges in reporting biomonitoring results in environmental epidemiology.

Abstract Number	**O-1-35-01**
Presenter	Matthew J. Bechle*, Dylan B. Millet, Julian D. Marshall
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Remote sensing of exposure to NO2: satellite versus ground based measurement in a large urban area

Background: Satellite remote sensing may be a powerful and useful tool for exploring spatial variability of air pollution within an urban area, particularly in countries or areas where direct measurement is lacking.Aims: To evaluate the ability of the Ozone Monitoring Instrument (OMI; satellite: Aura) to resolve urban-scale gradients in ground-level nitrogen dioxide (NO2) for a large urban area.Methods: We compared estimates of surface NO2 concentrations derived from OMI measurements and US EPA ambient monitoring stations. OMI provides daily afternoon (~13:30 local time) measurements of NO2 tropospheric column abundance. We used model-derived scaling factors (surface-to-column ratios, from GEOS-Chem and CAMx) to relate satellite column measurements to ground-level concentrations. We compared 4138 sets of paired data for 25 monitoring stations in the South Coast Air Basin of California for year-2005.Results: OMI measurements include more data gaps than the ground monitors (60% versus 5% of available data, respectively), owing to cloud contamination and imposed limits on pixel size. The spatial correlation between OMI columns and corrected in situ measurements is strong (r = 0.93 for annual average data), indicating that the within-urban spatial signature of surface NO2 is well resolved by the satellite sensor. Satellite-based surface estimates employing scaling factors from an urban model provide a reliable measure (annual mean bias: -13%; seasonal mean bias: <1% [spring] to -22% [fall]) of fine-scale surface NO2. OMI provides good spatial density in the study region (average area [km2] per measurement: 730 for the satellite sensor vs. 1,100 for the monitors).Conclusions: Satellite-derived estimates of NO2 from OMI provide a reliable measure of spatial variability in ground-level NO2 for a large urban area. Our findings suggest that OMI NO2 measurements are a useful tool for exploring urban air pollution, especially for locations without extensive ambient monitoring.

Abstract Number	**O-1-35-02**
Presenter	Vienneau Danielle, Kees de Hoogh*, Matthew J. Bechle, Rob Beelen, Randall V. Martin, Aaron van Donkelaar, Eric V. Novotny, Dylan B. Millet, Gerard Hoek, Julian D. Marshall
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

High resolution NO2 and PM10 models for Europe using satellite-derived measurements

Background: Land use regression (LUR) models have been successfully used to assess air pollution exposures at a variety of spatial scales. This paper explores the potential for improved continental scale modelling through use of satellite-derived pollutant measurements. Methods: LUR models for NO2 and PM10 were developed at a spatial resolution of 100m on the basis of >1500 monitoring sites across Western Europe. In addition to satellite-derived NO2 and PM, the percentage area of specific land use characteristics and length of major and minor roads were extracted in zones from 100m to 10,000m. Altitude, population density and distance to sea were also considered. LUR models with and without satellite-based measurements as predictor variables were developed for years 2005, 2006 and 2007 for all site types combined. Two different sources for land cover data were evaluated. Results: Based on annual-mean concentrations (natural log) at monitoring sites model performance for NO2 ranged from R2 = 0.48 (with validation R2 0.46) to 0.58 (0.56) and for PM10 ranged from R2 = 0.22 (0.25) to 0.50 (0.47). The best model for NO2 was obtained for year 2005, using CORINE land cover plus satellite data, whereas the best PM10 model was for 2007 and included the global land cover with satellite data. Inclusion of satellite data marginally improved model performance for NO2 (R2: 0.55 without, 0.58 with satellite data in year 2005) while greater improvements were seen for PM10 (R2: 0.36 without, 0.50 with satellite data in year 2007). Conclusions: Fine resolution Europe-wide models of NO2 and PM10 concentrations were developed using readily available data, with satellite-derived measurements improving model performance. Maps of these models were used to evaluate population exposures across Europe, and are available for use in epidemiological and health risk assessment studies.

Abstract Number	**O-1-35-03**
Presenter	Aleksandra Jedynska*, Gerard Hoek, Rob Beelen, Meng Wang, Josef Cyrys, Christian Madsen, Mark J Nieuwenhuijsen, Kees de Hoogh, Bert Brunekreef, Ingeborg Kooter
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

CONCENTRATIONS AND DEVELOPMENT OF LAND USE REGRESSION MODELS FOR SPECIFIC ORGANIC COMPONENTS IN 10 EUROPEAN LOCATIONS OF THE ESCAPE STUDY

Background:TRANSPHORM and ESCAPE are EU FP7 funded projects providing advanced knowledge on the impact of transport emissionsandoutdoor air pollutionon human health in Europe. In selected European locations both projects add air pollution exposure assessment to health data available from European cohort studies. Aim: The goal of the present study was development of land use regression (LUR) models which will be used in the later part of the project to assess exposure of participants of cohort studies to different air pollutants. Methods: In 10 study areas (The Netherlands, Oslo, Barcelona, Munich/Augsburg, Copenhagen, Helsinki, Athens, Paris, Rome, London): 8 PAH's, 13 hopanes/steranes, EC/OC were measured. This is in addition to NOx, PM2.5 and PM10 mass and reflectance, and metals measured at all ESCAPE locations. Based on three two-week samples taken at 20–40 street, urban and regional background sites, annual average concentrations were calculated which were further used as an input in LUR models. Various traffic and land-use related GIS-predictor variables were applied in models' development. LUR models were built with supervised stepwise selection method. Results: The highest median model explained variance (R2) was found for EC – 84% (range: 71-94%). Median R2 for OC was 51% (23-79%) and 68% (28-91%) for sumPAH's. The lowest median R2 was found for hopanes/steranes: 38% (13-73%). Cross validation R2 was on average 5 – 12% lower than R2. Predictor variables included in the model were traffic, population and natural areas. Conclusions: LUR models were developed with low (hopanes/steranes), moderate (OC, sumPAH) to high (EC) explained variance. Variability of R2 was caused by small concentration contrast within study area and lack of suitable GIS variables describing pollutants' sources (e.g. wood burning for PAH).

Abstract Number	**O-1-35-04**
Presenter	Hyunok Choi*, Frederica Perera, John D. Spengler
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Predicting Chronic Personal Exposure to Airborne Polycyclic Aromatic Hydrocarbon ?Mixture in Krakow, Poland

BACKGROUND: Polycyclic aromatic hydrocarbons (PAHs) are a globally distributed class of genotoxin and carcinogens. Inhalation PAHs, in particular, is an important route of exposure. Yet, in absence of directly monitoring of personal exposure (PE), estimating chronic PE to a mixture of airborne PAHs typically relies on proxy predictor variables. Here, we examined the performances of three prediction models of chronic PE. METHODS: In an on-going prospective birth cohort study, the pregnant women were directly monitored for their PE either once during the gestational period to eight carcinogenic PAHs and pyrene (n=266) or repeatedly, once during eachtrimester (n=78). Additional monitoring of the same PAHs in indoor and outdoor setting were also conducted. Three PE models were developed. Under the most resource-restricted scenario (model 1), we considered self-reported indoor and outdoor sources as proxy variables of PE. In the intermediate-resource scenario (model 2), we posited that the citywide demand for heating (unit, °C) is a proxy variable for PE to PAHs. Under the most resource abundant scenario (model 3), we posited that infiltrated indoor concentration of directly monitored outdoor mean concentrations represents a proxy of PE. RESULTS: Based on the Model 1, proxy variables for the pregnancy period as independent predictors explained ≥ 70% variability in PE to each of the nine PAHs (all Ps < 0.0001). Based on the Model 2, a single unit increase (°C) in citywide demand for heating was associated with 10% increase in PE to each of nine PAHs (all Ps < 0.0001). In addition, single unit increase in the wind speed (m/s) was associated with 30—40% reduction in PE to each of nine PAHs. Based on the Model 3, pooled 48-hour mean outdoor concentration for each of eight species explained 76—87% of total variability in PE to the same species. CONCLUSION: In Krakow, Poland, accurate and precise prediction of PE of nine PAHs is possible using inexpensive data sources.

Abstract Number	**O-1-35-05**
Presenter	Ayoung Jeong*, Harish C. Phuleria, Dirk Keidel, Thierry Rochat, Nicole Probst-Hensch, Christian Schindler
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

STABILITY OF AIR POLLUTION MODELS OVER TIME: EVALUATION OF POLLUMAP MODELS FOR THE SWISS COHORT STUDY, SAPALDIA

Background: In epidemiological studies investigating long term effects of air pollution, Gaussian dispersion and land-use regression modeling are generally used. Their applications typically assume stable spatial air pollution patterns over time. This assumption, however, must be examined. The SAPALDIA (Swiss Study on Air Pollution and Lung and Heart Diseases in Adults) cohort study completed its third health survey in 2010/11 and needs to update individual air pollution exposure histories of study participants since the last survey in 2001/3. Aims: We aim to evaluate the temporal stability of the PolluMap Gaussian dispersion model (2000 and 2010) predictions of PM10 and NO2 against empirical data from fixed site monitoring stations and to interpolate the models for intermediate years. Methods: First, the temporal stability of the PolluMap models over a 10-year period is evaluated by comparing model predictions with annually averaged measurements from fixed site monitoring stations. Second, statistical models of year-to-year changes in spatial air pollution patterns, mainly driven by annual variations in meteorology are derived based on measurements from fixed monitoring stations. In combination with the PolluMap models they will be used to build high resolution spatial models for each of the intermediate years. Results: Unlike dispersion model predictions, measured PM10 and NO2 levels showed slight decreases from 2000 to 2010 (22.0±5.0 to 21.1±5.4 micrg/m3 and 25.3±11.2 to 24.2±9.6 micrg/m3, respectively). For all sites and both years combined, high correlations were obtained for PM10 (R2= 0.53, N=51) and NO2 (R2=0.72, N=103). Models seem to overestimate at high altitude locations and underestimate at traffic sites. Conclusion: The good agreement between modeled and measured values of PM10 and NO2 in 2000 and 2010 holds promise for a successful temporal interpolation of these models.

Abstract Number	**O-1-35-06**
Presenter	Yuval ., Shlomo Bekhor, David M. Broday*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Data-driven model for generating air pollution maps at a high spatiotemporal resolution

BackgroundSpatially detailed estimation of exposure to air pollutants in the urban environment is needed for many air pollution epidemiological studies. To benefit studies of acute effects of air pollution such maps are required at a high temporal resolution.AimsThis study introduces nonlinear optimisation for the construction of detailed spatiotemporal air pollution exposure field. Methods An extensive traffic model output, serving as proxy for traffic emissions, is fitted via a nonlinear model embodying basic dispersion properties, to high temporal resolution routine observations of traffic-related air pollutant. An optimisation problem is formulated and solved at each time point to recover the unknown model parameters. These parameters are then used to produce a detailed concentration map of the pollutant for the whole area covered by the traffic model. Repeating the process for multiple time points results in the spatiotemporal concentration field. The exposure at any location and for any span of time can then be computed by integration of the concentration time series at selected receptor locations for the durations of desired periods.ResultsThe methodology is demonstrated for NO2 exposure using the output of a traffic model for the greater Tel Aviv area, Israel, and the half-hourly monitoring and meteorological data from the local air quality network. A leave-one-out cross-validation resulted in simulated half-hourly concentrations that are almost unbiased compared to the observations, with mean error (ME) of 5.2 ppb, normalized mean error (NME) of 32%, of the simulated values 78% are within factor of two (FAC2) of the observations, and the coefficient of determination (R2) is 0.6. Integrated values over the whole study period (the chronic exposure) are also unbiased compared with their corresponding observations, with ME of 2.5 ppb, NME of 18%, FAC2 of 1.0 and R2 that equals 0.62.ConclusionsThe proposed method can be used as a tool for air pollution exposure estimation for both acute and chronic empidemiological studies.

Abstract Number	**O-1-36-01**
Presenter	Toan Vu Duc*
Exposure	persistent organic pollutants
Health domains	healthrelated quality of life
Type of research	case-control study

Residual effect of Polychlorinated biphenyls (PCBs) in sediment from CauBay River, Vietnam

Background An evaluation of residual effect of Polychlorinated biphenyls (PCBs) in sediment from CauBay River, Vietnam was carried out. This river has been playing an important role in water supply and drainage for agriculture at Kieu Ky commune, Hanoi, the capital of Vietnam. Aims The aims of the this research are to assess the PCBs residue in sediment and its effect to the quality of soil of Kieu Ky commune at the downstream of CauBay river. Methods Twenty representative sediment and soil samples were collected in October 2012. The concentrations of PCBs in the sediment samples were investigated by GC/MS. Results In industrial and urban sampling sites, PCBs concentrations in sediment samples ranged from 10.02 to 169.52 ng g-1 dry weight, while those in agricultural sampling sites ranged from 8.02 to 24.37 ng g-1 dry weight. All sediment samples in CauBay river are lower than ERM level (180 ng g-1) and ninety percent of samples are higher than ERL level (22.7 ng g-1). Compositions analyses show that the predominance of heavily chlorinated PCBs, PCB138 and PCB153, are still remained when they penetrated the sediment from CauBay river and soil from Kieu Ky commune. In soil sample from Kieu Ky commune, PCBs was detected from 9.08 to 110.62 ng g-1 dry weight. There is a strong positive relation between residue of PCBs from sediment of CauBay river and from soil of Kieu Ky commune (Pearson' correlation coefficient is 0.87). Conclusions Wide occurrence and high residue of PCBs has been found in the study area. There is a strong positive relation between residue of PCBs from sediment of CauBay river and from soil of Kieu Ky commune. Compositions analyses show that the predominance of heavily chlorinated PCBs are still remained when they penetrated CauBay river. The long-time release of PCBs levels is observed.

Abstract Number	**O-1-36-02**
Presenter	Shamusideen Kadiri*, Nosakhare Ukpomwan, Dolapo Onipede
Exposure	persistent organic pollutants
Health domains	healthrelated quality of life
Type of research	health impact assessment

Oil Spills and Sustainable Development: NIGERIA EXPERIENCE

Background, Nigeria is the largest oil producer in Africa and the eleventh largest in the world. The mainstay of Nigeria's economy is the Petroleum sector, contributing about 90% of the nation's foreign exchange earnings and about 25% of the Gross Domestic Products. Unregulated actions such as oil spills by the oil industry destroy habitats and damage biodiversity. The consequences of this have been enormous financial loss, extensive habitat degradation, and poverty leading to the continuous crises in the Niger Delta Area, that have recently culminated into kidnapping of foreign oil workers, and even children. Aims This presentation seeks to examine the environmental consequences of oil exploration and distribution with particular emphasis on oil spillage and Sustainable Development in Nigeria. Method The paper uses extensive literature review both primary and secondary sources to give comprehensive information. Information was also elicited from the stakeholders with the use of designed questionnaire. Results, 'Oil drips" occurs during production process and transportation. Sabotage which has been identified as one of the causes, due to either penchant for making quick money by affected persons or as a means of venting anger on the oil producing companies, and the need to be given attention both by the Oil companies and the government. Additionally, the weakness of legislation in terms of inadequacy and unwillingness or incapacitation on the part of the government to enforce such legislations has made them quite ineffective. Conclusions The government should mandate all the oil companies operating in the region to embark on the continuous provision of infrastructure for the host communities. Specific laws on ecological restoration of oil spill sites should be developed in other to control of activities in Oil Industry.

Abstract Number	**O-1-36-03**
Presenter	Xinghua Qiu*
Exposure	persistent organic pollutants
Health domains	other
Type of research	others

Regional Polychlorinated Naphthalene (PCN) Exposure Based on Gridded Field Observations across North China

Background: Polychlorinated naphthalenes (PCNs) belong to a group of novel persistant organic pollutants (POPs) with dioxin-like toxicity. However little information is available regarding these pollutants. Objective: The aim of this study was to explore the spatial distribution and sources of PCNs in North China, and to evaluate the risk of inhalation expoure to these pollutants. Methods: Gridded field observations coupled with passive air sampling were completed in North China, with a grid interval of approximately 70 km. In total 90 sampling sites were asigned, and 29 congeners of tetra- through octa-PCN were analyzed using GC-ECNI-MS. Results: A median concentration of 48 pg m-3 (ranged from 10 to 2460 pg m-3) indicated heavy PCN pollution in this region. The relative abundance of PCN52, PCN67, and PCN73 suggested that the predominant origin was as a by-product of thermal processes rather than from commercial mixtures. It was estimated that ~90% of observed PCNs were from by-product of thermal processes, and non-point emissions contributed ~65% of the total PCNs observed in the study. The estimated toxic equivalent quantity (TEQ) for dioxin-like PCNs ranged from 0.97 to 687 fg TEQ m-3, which contributed up to 4.3% of the maximum tolerable daily intake level established by the World Health Organization (WHO-TDI; 4 pg TEQ/kg/day) throught inhaltion intake of ambient air. Conclusions: We conclude that residents of North China are likely to be exposed to considerable dioxin-like toxic risks.

Abstract Number	**O-1-36-04**
Presenter	Jiefeng Zhang*, Victor W.C. Chang
Exposure	organic compounds
Health domains	healthrelated quality of life
Type of research	health impact assessment

Source Separation and Urine Treatment – A way towards zero-discharge of nutrients and pharmaceuticals (cytostatic drugs) to the environment

Background: The continuous discharge of nutrients and pharmaceutical residues potentially create a threat to our urban aquatic environment and water safety. This is extremely important for some metropolitans that rely on the renewable/reclaimable water resources such as Singapore. Source separation strategy promises to improve the conventional centralized wastewater management practice towards a more sustainable way. Aims: The study investigated the feasibility and life-cycle impacts of engaging forward osmosis-based process for spontaneous nutrient recovery, water reclamation and pharmaceutical (i.e. toxic cytostatic drugs) rejection from source-separated urine (yellow water). Methods: Source separation system was built up for separate collection of different wastewater streams (i.e. yellow water, brown water, etc.). Integrated FO-based experiments and environmental life-cycle impact assessment were carried out to evaluate the proposed decentralized system, with special focus on human health and resources recovery. Results: High water flux and of nutrient (N, P, K) rejection were achieved by forward osmosis using desalination brine as cost-effective draw solution. Both fresh and hydrolyzed urine could be used as feed water, while the former caused higher potential of membrane fouling. The process also favorablly rejected most of the cytostatic drugs tested, though further advanced oxidative treatment was recommended to detoxify the dewatered retentate prior to nutrient recovery. Life-cycle assessment revealed that the proposed decentralized sanitation system reduced the adverse impacts on human health and urban aquatic environment. Conclusions: The combination of source separation strategy and FO-based treatment is promising to shift the urban wastewater management practice towards an essentially sustainable diagram, in terms of resource recovery and low–discharge of nutrients as well as pharmaceutical residues to the environment.

Abstract Number	**O-1-36-05**
Presenter	Ania Stasinska, Jane Heyworth*, Andrea Hinwood, Alison Reid, Jon Ø. Ødland, Phi Duong Trong, Quoc Ho Van, Anna Callan
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Maternal plasma concentrations of polybrominated diphenyl ether (PBDE) and infant birth weight

Background Exposure to brominated flame retardants is an emerging area of health concern with epidemiological studies reporting neurobehavioural and neurotoxic effects. To date, a small number of studies have investigated the association between PBDE concentrations and birth outcomes although findings have been inconsistent. The mechanisms by which PBDEs may affect birth outcomes are unknown, however PBDEs influence on thyroid hormone homeostasis may be involved. Aims The aim of this study was to assess exposure to PBDEs among pregnant women in Western Australia. The association with infant birth weight was also investigated. Methods Pregnant women, aged 18 years or older, non-smokers, not occupationally exposed to persistent organic pollutants and living in Western Australia (n=173) were recruited between 2008 and 2011 to the Australian Maternal Exposure to Toxic Substances (AMETS) study. Participants completed a questionnaire on demographic and lifestyle information as well as activities that may increase exposure to PBDEs. Birth weight was collected by a follow up questionnaire. At 38 weeks gestation, participants provided a plasma sample and these were analysed for concentrations of BDE-47, -99, -100, -153 and -154. STATA12 was used for the statistical analysis. The relationship between birth weight and maternal PBDE concentrations was investigated using logistic regression. Results Mean age of respondents was 32 years and for 48.5% of women this was their first pregnancy. The concentrations of S5PBDE ranged from 13.2 to 1389.6 pg/g ww with a median of 54.3 pg/g ww. Adjusting for a range of potential confounders a unit increase in lnBDE-47 reduced birth weight by 73.3 grams (95%CI -141.62, -4.95) and 78.8 for lnBDE-100 (95%CI -147.49, -10.43). However, confidence intervals are wide and the adjusted R2s are small (0.21 for both). Conclusions Maternal concentrations of BDE-47 and -100 may reduce infant birth weight. This should be investigated further in a larger study.

Abstract Number	**O-1-36-06**
Presenter	Tony Fletcher*
Exposure	persistent organic pollutants
Health domains	cardiovascular disease
Type of research	health impact assessment

Risk assessment and setting no adverse effect levels for PFOA

Background: Studies of perfluorooctanoic acid (PFOA) have shown associations with a number of biomarkers of biological effect and disease. The C8 Science Panel following a large research programme in the Mid Ohio Valley, has concluded that there is a probable link between PFOA and the following: liver and testes cancer, thyroid disease, preeclampsia, colitis and high cholesterol. While these conclusions support the hazard classification of PFOA, under European REACH legislation (Registration, Evaluation, Authorisation and Restriction of Chemicals), a DNEL Derived No Effect Level for human exposure also needs to be defined. Objectives: Based on a large population with individual data on PFOA exposure, covariates and clinical markers of biological effect, to investigate the shape of the dose response relationship at levels relevant to limit setting under REACH. Methods and Results: In 2005/6 a population of nearly 69000 people provided information by questionnaire and provided blood samples, with clinical markers of, among others, PFOA, lipids and thyroid hormones in serum. A cohort follow up of this cross sectional population allowed diagnosed disease to be investigated in relation to modeled PFOA serum levels. There was consistency in the direction of positive slopes for associations between raised lipids and measured PFOA in cross sectional analysis, and hyperlipidemia and modeled PFOA in the longitudinal analysis. While the modeled and measured levels overall are well correlated (r=0.7), in the low exposure range correlation is poor. To assess the shape of dose response curves at the lower range of the population exposures, the measured serum levels are more informative, although potentially more vulnerable to confounding for example from variation in PFOA excretion. The slope of cholesterol per unit of PFOA is steeper at lower levels, below 50 ng/ml, providing little evidence of a threshold of effect in these data. Further work, fitting threshold and curves such as cubic splines and integrated exposure response functions is ongoing.

Abstract Number	**O-1-37-01**
Presenter	Menno Keuken*, Sef Elshout van den, Fulvio Amato
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Exposure of urban population to traffic-related primary particulate matter

Background In epidemiological studies, the distance to road traffic is often applied to assess the populations' exposure to air pollution. This is likely to be adequate near motorways, where traffic-related air pollution decrease exponential with the distance to the motorways. However, for street canyons this is not the case, as air pollution is mainly dispersed at roof level. Consequently, the distance to a street canyon is less adequate to assess the populations' exposure: either one lives along a busy street canyon or one does not. Hence, for exposure assessment, it seems more appropriate to distinguish people living along busy street canyons from the rest of the urban population and assess their exposure with street canyon models. To test this hypothesis, we studied traffic-related primary particulate matter (PM) in the city of Rotterdam. Aims To study the contribution of exhaust emissions, break and tire wear, and re-suspension of road dust to PM in a street canyon and dispersion of PM to the urban background. Methods Measurement of elemental carbon, PM2.5 and PM10, and chemical composition in a street canyon, on the roof level and at the urban background followed by source apportionment. Results In Rotterdam, 8% of the urban population lives along street canyons with 60% of the urban road traffic and they are exposed to 2-3 times higher traffic-related primary PM than the rest of the urban population. Conclusions In urban areas with street canyons, exposure assessment of traffic-related primary PM based on exponential-decreasing dilution overestimatesthe number of exposed people and underestimatesthe exposure level of people living in busy street canyons. Street canyon models may provide a more adequate exposure assessment.

Abstract Number	**O-1-37-02**
Presenter	Markey Johnson*, Liu Sun, Andrew Davidson, Elizabeth Saikali, Jue Yi (Joyce) Zhang, Mark Gibson
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Modelling the Spatial Distribution of Industrial and Traffic Pollution Mixtures across Canada

Background: Air pollution has been associated with a variety of adverse health outcomes. Air pollution health effects may vary by pollutant mixture, with source acting as an important indicator of mixture composition. However, pollutant mixtures are often complex and difficult to assess. This study used source apportionment to identify pollutant sources and quantify their contributions to pollutant mixtures at regulatory monitoring sites. Land-use regression (LUR) modelling was then used to predict the spatial distribution of sector-based air pollution mixtures. Methods: Source apportionment was conducted using positive matrix factorization (PMF) on volatile organic compounds (VOCs) measured from 2006 to 2009 at 47 regulatory monitoring sites across Canada. Factor masses generated for each industrial or trafic source at each site were modelled as the dependant variable in LUR analyses. Model predictors included sector-specific facilities and land-use zoning within buffer areas ranging from 500 meters (m) to 20 kilometers (km) generated using ArcMap-10.0. For traffic models, road density and distance to major roads were also included. Models were selected based on adjusted r-squared, akaike’s information criterion, and variance inflation factor using SAS-9.2. Results: PMF models identified source impacts from five major industrial sectors as well as traffic. LUR models explained approximately 70% of the variability in sector-specific pollution for four of the industrial sectors. Major predictors included sector-specific facilities within 500m to 10km. Traffic models are still under development. An improvement is expected when wind speed and direction are incorporated into the models. Conclusions: Our results demonstrate that land-use information can be combined with source attribution obtained from PMF receptor modelling to predict pollutant concentrations associated with specific industrial sectors at un-monitored sites. These models will be applied in future health studies to examine whether air pollution health effects vary by industrial sector.

Abstract Number	**O-1-37-03**
Presenter	Allison P Patton*, Caitlin Collins, Wig Zamore, Elena N Naumova, Doug Brugge, John L Durant
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Regression Models of traffic-related ultrafine particles in Near-Highway Neighborhoods

Background: Models are needed that allow fine temporal- and spatial-scale predictions of exposure to airborne ultrafine particles (UFP) in urban neighborhoods near highways. Aims: The aims of this work were to (1) develop spatial-temporal regression models of UFP in three Boston-area (MA, USA) neighborhoods (<1 km2 each) near Interstate 93 (I-93) for the Community Assessment of Freeway Exposure and Health (CAFEH) study, and (2) use the models to explore the relative importance of spatial and temporal factors on near-highway UFP concentrations. The neighborhoods included Chinatown, an ultra-urban area with tall buildings and street canyons, and Somerville and Dorchester, two mixed residential-commercial neighborhoods with major roads. Methods: Data was collected with a mobile monitoring lab equipped with rapid-response instruments to measure particle number concentration (PNC; 4-3,000 nm, a proxy for UFP) and other pollutants. In each neighborhood, monitoring was performed on >30 days over the course of a year. Independent covariates in UFP regression models included wind direction, wind speed, temperature, distance from I-93 and other major roads, road class. Results: Temporal variables explained ~40% of the variability in ln(PNC) while spatial variables explained only ~7%. Wind direction alone explained up to 15% of the PNC variation in each of these neighborhoods. In univariate models, PNC decreased by ~14% over the first 400 m from I-93, explaining ~6% of the PNC variation in Somerville and Dorchester but only 1% of the variation in Chinatown, where the density of major roads was much higher. Conclusions: Our regression models explain ~50% of the spatial-temporal PNC variability in near-highway neighborhoods. Temporal variables explain more of the near-highway UFP variation than spatial variables, especially in the ultra-urban neighborhood.

Abstract Number	**O-1-37-04**
Presenter	Ian Longley*, Huimin Lin, Jennifer Salmond, Nick Talbot, Woodrow Pattinson
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Contribution of school location and travel-to-school on schoolchildren's exposure to ultrafine particles at four schools with contrasting traffic influence

Background The UPTECH International study aims to test the association between children's exposure to ultrafine particles and a range of health outcomes by quantifying exposure associated with schools. Aims A New Zealand pilot study was conducted to provide data on the range of likely exposures, and the significance of travel-to-school to inform future study design. Our hypotheses were that exposure was related to traffic volumes adjacent to the school, in the wider community and along common travel-to-school routes. Method Two pairs of schools in Auckland were selected representing high and low traffic volumes on adjacent roads – one pair in suburban and another in central locations. At each school ultrafine particles were measured at an outdoor location, in a classroom and during pedestrian journeys between school and local addresses for at least 2 weeks. Results Of the two suburban schools, the ratio of average ambient concentrations between high and low traffic schools was 1.6 (2.9 for personal exposure). The corresponding ratios between high-traffic central and suburban schools were 1.5 and 1.3. Across all schools the ratio of average personal exposures during school travel to average daytime ambient concentrations ranged from 0.7 to 4.6. We estimated that the contribution of travel-to-school to integrated dose during the school day was 4 – 5 % at the suburban schools and 19 – 21 % at the central schools, despite travel accounting for only 8 % of the school day time. These proportions increase if likely variations in breathing rate are considered. Conclusions Traffic volumes at two different scales (adjacent to school and in the wider community) had a significant effect on differences in ultrafine particle exposures between four schools. Travel-to-school exposures were higher and made a greater contribution to total exposure in the central-city schools relative to suburban schools.

Abstract Number	**O-1-37-05**
Presenter	Steve Hankey*, Greg Lindsey, Julian D. Marshall
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Comparing spatial patterns of non-motorized traffic and particulate air pollution in Minneapolis, MN

Background: Non-motorized traffic volumes and air pollution concentrations vary on small spatial scales (i.e., within cities). The spatial patterns of non-motorized traffic and air pollution may impact cyclists' and pedestrians' exposure to hazardous air pollution. Aim: Explore how particulate air pollution varies with non-motorized traffic volumes, and thereby identify high- and low-exposure areas for pedestrians' and cyclists'. Methods: Our estimates of air pollution exposures for pedestrians and cyclists in Minneapolis, MN, combines three spatially- and temporally-resolved inputs: (1) pedestrian traffic volumes, (2) bicycle traffic volumes, and (3) particulate air pollution concentrations (particle number, PM2.5, black carbon). Each input has a spatial resolution that allows for block-by-block estimates of non-motorized travel and air pollution concentrations. We explore correlates of the built environment and overall air pollution exposure during active travel. Results: Our approach provides spatially- and temporally-resolved estimates of air pollution exposure to walkers and bikers. We find that spatial patterns of exposure (and the relationship with the built environment) differ between pedestrians and cyclists. For example, we found heavy pedestrian traffic is mostly on streets with high air pollution (arterial streets: 706 pedestrians per day, 19,009 pt/cc) and heavy bicycle traffic is on off-street trails with low air pollution (off-street trails: 701 cyclists per day, 13,186 pt/cc). Population-weighted particle number concentrations for total non-motorized travel were higher for high traffic roads (arterials or collectors) than for local roads or off-street trails (arterial: 19,037 pt/cc, collector: 20,272 pt/cc, local: 15,624 pt/cc, off-street trail: 13,354 pt/cc). Policy implications: Our approach illustrates how pollution exposures for non-motorized travelers vary with the built environment, and highlights exposure hot spots where pedestrian or bicycle traffic is high and where air pollution concentrations are high.

Abstract Number	**O-1-37-06**
Presenter	Christer Johansson*, Sanna Silvergren, Michael Norman, Billy Sjövall
Exposure	ambient air pollution
Health domains	policy
Type of research	exposure measurement

Exposure of air pollutants inside vehicles while driving in road tunnels

Background. A 21 km by-pass highway is planned to meet increased transport needs in Stockholm. With 18 km's in a road tunnel it will be one of Europe's longest highway tunnel (140,000 vehicles per day). Health risks of tunnel user exposure to air pollution need to be considered. Aim. To assess the concentration of air pollutants inside vehicles in relation to the tunnel air. Methods. Measurements have been performed inside and outside vehicles while driving through an existing four km long road tunnel in Stockholm. Measurements included PM10, PM2.5, black carbon (BC), total particle number concentration (PN, >20 nm diameter) and NOx. Two instrument setups were used to measure outside the vehicles and at breathing height inside the cabin. Three private cars, a light goods van and a public transport bus were used. The vehicles were tested with ventilation taking air from outside and recirculation of the cabin air. Results. With recirculation of cabin air while driving through the tunnel was very efficient in keeping pollutant concentrations inside the cabin low. For all cars and all components, less than 10 % of the tunnel air concentration was observed in the cabin when using recirculation. During ventilation the fraction of pollutants that entered the cabin air varied significantly between the components. Most of the larger particles are being filtrated and only a few per cent of the PM10 entered the cabin. The coarse fraction of PM10 (2.5-10 µm) is significantly increased in Stockholm due to the road wear by studded winter tyres. Smaller particles, BC and PN are not filtered effectively. Approx. 40 % of the PN and BC entered the newest of the tested vehicles, the Volvo. Nitrogen oxides (NOx) are gaseous compounds that are not efficiently filtered by conventional car filters. Conclusions. Our study shows the importance of considering size resolved particle concentration inside car cabins in order to assess potential health impacts of car driver's/commuters using road tunnels.

Abstract Number	**O-1-39-01**
Presenter	Ajay Pillarisetti*, Sankar Sambandam, Mayur Vaswani, Narendra K. Arora, Kalpana Balakrishnan, Michael N. Bates, Darby Jack, Krishnendu Mukhopadhyay, Rupak Mukhopadhyay, S. Arul Selvan, Kirk R. Smith
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Evaluating the impacts of an advanced stove intervention on traditional cooking patterns and pollutant exposures in India using Stove Use Monitors

Background/Aims. Household air pollution in 2010 was responsible for ~3.5 million premature deaths and 500,000 through contributions to outdoor air pollution. 900,000 of these deaths occurred in India, where ~66% of households rely on wood, dung, or crop residues as their primary cooking fuels. Since alternative fuels are unlikely to become available soon, cleaner ways of using these fuels need evaluation. Methods. Beginning in 2012 as part of ongoing work at the SOMAARTH surveillance area in Palwal district, Haryana, we distributed 200 forced-draft ('advanced') biomass stoves to pregnant women. These stoves have low laboratory emissions and good field evaluations. Using Stove Use Monitors (SUMs), portable data-logging thermometers, we monitored usage of traditional and intervention stoves. This revealed how use patterns changed after advanced stove introduction. In a subset of homes, we monitored PM2.5 and carbon monoxide (CO) in kitchens and personal CO exposures of participants. SUMs were placed on traditional stoves up to 2 weeks before SUMs-equipped advanced stove dissemination. Prior to and following advanced stove distribution, pollutant concentrations were assessed over 48-hour periods in a subset of homes. SUMs logged temperatures every 10 minutes and were downloaded twice monthly. Nearly 400 stoves continue to be monitored, yielding over 110,000 stove-days of data. Results/Conclusions. Personal CO exposures decreased post intervention from 10.9 ppm to 4.8 ppm. Area PM and CO concentrations by 59.8% and 55.9% respectively. Prior to the intervention, households used traditional stoves twice daily on average - consistent with previous findings. A small proportion of households used advanced stoves only. The majority used both stoves, a phenomenon termed "stacking," which has profound implications for intervention strategies, as traditional stoves dominate household emissions and drive personal exposures. Mixed effects models were used to evaluate the contribution of stove type and household characteristics to area concentrations and personal exposures.

Abstract Number	**O-1-39-02**
Presenter	Ricardo Luis Teles de Carvalho*, Ole Michael Jensen, Luis Antonio da Cruz Tarelho, Adeildo Cabral da Silva
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Indoor air pollution caused by wood-burning in Brazilian and Danish dwellings

Residential wood-burning is considered by the scientific community as the 4th major cause of deaths in the developing countries due to the indoor air contamination and a cause of regional air pollution in the northern countries. In the first case, wood is being used by low income people that still rely on it for cooking purposes and in the second case is commonly used as an economical heating fuel for creating a cozy atmosphere. In both cases, wood-burning stoves cause the exposure of the building occupants to overheating and indoor pollution, in the equatorial regions in naturally ventilated households and in northern Europe in low energy houses. This article aims to compare the level of both indoor particles and temperature in two different types of buildings in two extremely different world regions. The field research was conducted under the same operating conditions of wood-burning stoves in two different contexts from South to North, through two indoor climate campaigns in single family households. In Brazil the field work was carried out in 5 traditional houses and in Denmark in 5 energy efficient households. This comparative study reveled that temperature over 35ºC can be achieved in Brazilian households due to even when using the efficient masonry stove and in the case of Danish modern households temperature can reach 30ºC during the use of Nordic labeled cast-iron stoves. Moreover, even the wood combustion in efficient stoves resulted in PM10 concentrations levels over 1000 µg/m3 and when using Danish heating stoves in modern dwellings that concentrations were higher than 150 µg/m3. This study shows that even the most efficient stoves used in both developing and developed countries cause indoor climate issues. Thus, there is a need for a better integration of wood-burning stoves taking into account the building envelope energy performance and user´s practices, fitting the right innovations to the built environment.

Abstract Number	**O-1-39-03**
Presenter	Darby Jack*, Ajay Pillarisetti, Mayur Vaswani, Kalpana Balakrishnan, Michael N. Bates, Manoj Das, Patrick Kinney, Rupak Rupak Mukhopadhyay, Kirk R. Smith, Narendra K. Arora
Exposure	household air pollution
Health domains	policy
Type of research	randomized trial

What determines the adoption and continued use of advanced clean cookstoves?

Background: Household air pollution is thought to be a top environmental health risk globally, and recent assessments suggest that it is the overall leading cause of DALYs in South Asia. Despite this burden of disease, solutions remain elusive. Household adoption of clean energy systems is a necessary condition for successful policies to address this problem.Aims: We set out to assess determinants of stove use, including individual, household, and village level characteristics, and analyzed potential benefits of home encouragement visits by community health workers.Methods: We distributed high-efficiency forced draft stoves to 200 women in seven rural villages, in the context of the India Newborn Stove Study Pilot in the SOMAARTH surveillance site, Haryana, India. Using stove use monitors (SUMS), we tracked stove use for a period of at least six months by logging the temperatures of the stoves every ten minutes. We sought to encourage stove use with periodic visits by community health workers (known locally as Accredited Social Health Activists - ASHAs). For about half of the households, randomized at the village level, ASHAs received a small payment for each stove use visit. In the other households the ASHAs were asked to visit, but were given no financial or other incentive to do so.Results: We report the results of modeling that estimates the relative influence of a range of household and demographic factors on stove use. In addition, we found that in incentivized villages ASHA workers started by making about 96% of expected visits, which fell to 83% over the course of the study. In non-incentivized villages, ASHAs only made 32% of expected visits in the first period, and by the end of the study visits had dropped nearly to zero.Conclusions: SUMs offer a valuable tool understanding determinants stove adoption, and the value of the data they provide increases with tracking duration. Cookstove interventions that rely on community health workers to encourage stove use should consider incentives or other strategies to secure their long-term participation.

Abstract Number	**O-1-39-04**
Presenter	Julia Hurraß*, Freya Schulte-Hubbert, Andreas Rehmers, Armin Schuster, Richard Gminski, Volker Mersch-Sundermann
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Measurement of indoor air emissions during the construction of a modern timber frame house

Background: Emissions from newly constructed buildings can have an adverse impact on health or quality of life. Usually volatile organic compounds (VOC) emitted from single building materials are studied in a test chamber or cytotoxic effects of single compounds are determined. In this study, the complex VOC profile was documentedduring the construction of a timber frame house. Additionally, cytotoxic effects were examined by exposing human lung cells with air sampled in the building. Methods:During the 19 week finishing period of the house, 8 indoor air measurements were performed, comprising VOC and aldehydes and ketones of low molecular weight, sampled by Tenax TA and DNPH and measured by GC/MS and HPLC/DAD, respectively. To determine cytotoxic effects on A549 cells by WST-1-assay and the release of inflammation indicators IL-8 and TNF-α, indoor air samples were collected by FlexFoil bags. In all experiments with these air samples, Vitrocell® exposure modules were used. The same assays were performed exposing cells to the exhaust of an emission chamber loaded with oriented strand board (OSB) or thermo hemp isolation material, which were used for the house. Results:The air exchange rate in the house was as low as 0,2 h-1 and concentrations of wood specific substances reached their maximum levels in week 2 with aliphatic aldehydes (C4-C11) and bicyclic terpenes (862 µg/m³ and 823 µg/m³, respectively). Neither the indoor air during the house construction phase nor the construction materials' emissions showed significant cytotoxic effects or impacts on cytokine release in the cell biological tests. Conclusions: In order to assess real exposure situations, analyses of indoor air should be conducted in addition to chamber measurements of the building materials. Our results show that even in houses with OSB exterior walls, good indoor air quality can be achieved within several weeks.

Abstract Number	**O-1-39-05**
Presenter	Bryan Christensen*, Tamara Pilishvili, Fuyuen Yip, Kanta Sircar, Jennifer Loo, Nigel Bruce, Ibrahim Sadumah, Ronald Nyagol, Justus Muoki, Mike Sage
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Exposure Assessment of Household Air Pollution (HAP) and Improved Stove Use in Rural Western Kenya

Background Nearly 3 billion people worldwide use solid fuel as their main household fuel source; household air pollution (HAP) from burning biomass fuels was identified as a risk factor for health effects including respiratory and cardiovascular disease. WHO recently concluded that improved combustion stoves, improved ventilation, and/or reducing solid fuel use can help reduce HAP. Aims Describe indoor and personal exposures to carbon monoxide (CO) and fine particulate matter (PM2.5) for the traditional open fire cooking method and six different improved stoves, as part of a larger evaluation to identify stoves that can be made available in Kenya. Methods We conducted an exposure assessment in 43 households in two Kenyan villages to measure HAP for the traditional open fire cooking method (baseline) and each improved stove. We collected 48-hour PM2.5 and CO samples in the kitchen area. We concurrently measured personal CO from the mother and child, and collected urine samples from both during each sampling period to analyze for polyaromatic hydrocarbons (PAH). Stove use monitor systems (SUMS) were also deployed to assess stove usage and acceptability. We performed descriptive analysis and compared paired measurements before and after installation of the improved stove. Results Our preliminary data in 43 households showed an average 48-hour baseline kitchen PM2.5 and CO concentration of 0.985 ± 1.03 mg/m³ and 8.18 ± 6.90 ppm, respectively. Additional analyses are ongoing; we will be presenting data on the changes in PM2.5 and CO concentrations in comparison with baseline and improved stoves as well as corresponding urinary PAH concentrations. We will also summarize SUMS data to help illustrate stove use practices and its influence on HAP. Conclusions This study provides a unique opportunity to more clearly characterize personal and indoor exposures to cookstove emissions from traditional and improved stoves using a comprehensive sampling approach. Our findings will help to inform the types of stoves that could be made available in Kenya.

Abstract Number	**O-1-40-01**
Presenter	Lidia Casas*, Christina Tischer, Inge M Wouters, Maties Torrent, Raquel Garcia, Anne Hyvärinen, Jordi Sunyer
Exposure	microbial environment
Health domains	respiratory disease
Type of research	cohort study

Early life microbial exposure and fractional exhaled nitric oxide in school-age children

Background: Early life exposure to microbial agents may have an effect on the development of the immune system and on respiratory health later in life. Inflammation is a key factor in the pathogenesis of respiratory diseases. Aims: To evaluate the associations between early life microbial exposures, and the fractional exhaled nitric oxide (FeNO), a biomarker of eosinophilic airway inflammation, at school age. Methods: In homes of participants of three prospective European birth cohorts (LISA, n=182; PIAMA, n=244; and INMA, n=355), endotoxin, EPS and β(1,3)-D-glucan were measured in living room dust collected at 2-3 months of age. Home dampness and pet ownership were periodically reported by the parents through questionnaires. FeNO was measured at age 8 for PIAMA and at age 10/11 for LISA and INMA. Cohort-specific associations between the indoor microbial exposures and FeNO were evaluated using multivariable regression analyses. Estimates were combined using random-effects meta-analyses. Results: FeNO at school age was significantly lower in children exposed to endotoxin at age 2-3 months (β -0.054, 95% confidence interval (CI) -0.97;-0.01) and in children with reported dog ownership during the first two years of life (GM ratio 0.82, CI 0.70-0.96). FeNO was not significantly associated with early life exposure to EPS, β(1,3)-D-glucan, indoor dampness and cat ownership. Conclusion: Early life exposure to bacterial endotoxin and early life dog ownership are associated with lower FeNO at school age. Further studies have to unravel the underlying effect mechanisms and possible clinical relevance of this finding.

Abstract Number	**O-1-40-02**
Presenter	Maria Valkonen*, Inge M Wouters, Martin Täubel, Jon Genuneit, Helena Rintala, Dick Heederik, Charlotte Braun-Fahrländer, Renaud Piarroux, Erika von Mutius, Anne Hyvärinen
Exposure	microbial environment
Health domains	allergies
Type of research	exposure measurement

Diversity and quantity of bacteria in farm and non-farm environments and the relation to asthma and allergy

Background Prevalence of asthma and atopic diseases have increased in the last decades and it is clear that this trend is more pronounced in children living in cities compared with children who live in farm environments. There is still little known about the factors and mechanisms behind this protective quality. Aims The aim of this study was to identify bacterial exposures in the context of the farming environment that are associated with asthma or atopy. Methods Mattress dust samples were collected from children from farmers, exposed non-farmers and controls homes and analysed using denaturing gradient gel electrophoresis (DGGE) to obtain a spectrum of bacterial signals. Dichotomized DGGE bands occurrence data were analysed against asthma, atopy and other health outcomes and environmental factors using Tobit regression and Chi-square test. Bands with significant associations ($p<0.05$) were identified; based on these findings, selected bacterial groups were subsequently targeted and quantified using quantitative polymerase chain reaction (qPCR). We used splined analysis, adjusted for age and gender, to explore associations between levels of microbes and health outcomes. Results All together 43 DGGE bands were found, six of them were significantly associated with asthma or atopy. Four bacterial groups were quantified via qPCR; Mycobacterium spp., Bifidobacterium spp., Clostridium spp. cluster I and cluster XI. Enumeration in the different exposure strata resulted in highest levels of microbes in homes from farm children, except for Bifidobacterium spp.We observed inverse associations between levels of all of these bacterial groups and atopy; these associations were specifically visible in the non-farm children. Conclusions The study design and methodological approach followed here allowed to identify bacterial signals in mattress dust with indication to be protective for asthma and allergy. Quantitative levels of these bacterial groups confirmed inverse association to atopy in children.

Abstract Number	**O-1-40-03**
Presenter	Dick Heederik*, Inge M Wouters, Martin Täubel, Charlotte Braun-Fahrländer, Renaud Piarroux, Virissa Lenters, Anne Hyvärinen, Erika von Mutius
Exposure	microbial environment
Health domains	respiratory disease
Type of research	cross-sectional study

Microbial markers in farm and non-farm environments and asthma and allergy

Background Exposure to microorganisms and microorganism associated molecular patterns has been associated with a reduced prevalence of atopy and asthma, especially in children living in farm environments. Up to now, only few microbial markers have been explored in epidemiological studies for their potential protective effects. Aims The aim of this study was to identify bacterial markers of exposure that are associated with asthma or atopy. Methods Mattress dust samples and passive sedimented dust samples in their bedrooms were collected from approximately 450 children from farmers, exposed non-farmers and controls homes. These were analysed for different bacterial and fungal markers such as endotoxin, β(1®3)glucans, extracellular polysaccharides, muramic acid and we applied a new assay which measures TLR2-ligands and a few qPCR markers. We assessed associations between exposures dichotomous outcomes by using splines, adjusting for age and sex and explored associations between multiple exposures and asthma and atopy. Results Children living on farms had a clearly lower risk for being atopic. This differences was less clear for asthma. We observed inverse associations between the levels of all microbial markers and atopy, but not with asthma. The measured microbial markers poorly explained the farm effect in a multiple regression model. Conclusions Quantitative levels of bacterial and fungal markers do seem to have inverse (protective) association with atopy in children. Different markers than studied before seem associated and this may point to different relevant microbial signals with regard to protective effects for atopy. More advanced modelling using discriminant analysis type of approaches is ongoing to explore which agents are most clearly associated and whether different markers show signs of clustering.

Abstract Number	**O-1-40-04**
Presenter	Karen Dannemiller*, Mark J Mendell, Janet Macher, Kazukiyo Kumagai, Nina Holland, Kim Harley, Asa Bradman, Brenda Eskenazi, Jordan Peccia
Exposure	microbial environment
Health domains	respiratory disease
Type of research	case-control study

The relationship between fungal diversity in house dust and childhood asthma development

Background: Childhood asthma prevalence has increased in recent decades. A relationship between early fungal diversity exposure and later asthma development, per the hygiene hypothesis, has not been established due to the absence of quantitative, unbiased techniques to measure fungal diversity. Aims: We used next-generation DNA sequencing to quantitatively evaluate fungal taxa and diversity in house dust samples without the biases of culturing. This research aims to characterize relationships among fungal taxa and diversity in house dust, measured wall moisture, and later asthma development in children. Methods: House dust and environmental measurements, including wall moisture, were collected in the CHAMACOS birth cohort study in Salinas, CA at child age 12 months. Current asthma status was evaluated at age 7 years in the available 292 children. A nested case-control analysis included 13 asthma cases and 28 controls. Dust was analyzed by 454 pyrosequencing to determine fungal identifications and diversity (number of different species per normalized sample). Results: Children from homes with low fungal diversity had an odds ratio of 4.8 (95% confidence limits 1.04-22.1) for developing asthma, not due to confounding. Homes with high measured moisture had increased fungal diversity. Negative confounding by moisture partially obscured the relationship between fungal diversity and asthma. No fungal taxa (species, genus, class) were significantly more common in asthma case homes but some taxa were significantly more common in control homes. Over 30 unique fungal taxa were significantly associated with moisture or mold indicators. Conclusions: This study avoided fungal culturing biases by using next-generation DNA sequencing to evaluate fungal diversity and taxa in house dust. Our findings suggest that low fungal diversity is associated with childhood asthma development.

Abstract Number	**O-1-40-05**
Presenter	Kwonchul Ha*, Chungsik Yoon, Donguk Park
Exposure	microbial environment
Health domains	allergies
Type of research	exposure measurement

The Association of Indoor Bioaerosol and Atopy at the Residence of Children in Korea

Backgrounds Exposure to bioaerosols in the indoor environment could be associated with a variety adverse health effects, including allergic disease such atopy or atopic syndrome. Aims The objectives of this study were to assess children''s exposure to bioaerosol in home indoor environments and to evaluate the association between atopy and bioaerosol, environmental, and social factors in Korea. Methods Samples of viable airborne bacteria and fungi were collected by impaction onto agar plates using a Quick Take TM 30 and were counted as CFU/m3. The environmental factors and possible causes of atopy based on ISAAC were collected by questionnaire. Results The bioaerosol concentrations in indoor environments showed log-normal distribution ($p < 0.01$). Geometric mean (GM) and geometric standard deviation (GSD) of airborne bacteria and fungi in homes were 189.0 (2.5), 346.1(2.0) CFU/m3, respectively. Indoor fungal levels were significantly higher than those of bacteria ($p < 0.001$). The means of indoor to outdoor ratio (I/O) for airborne bacteria and fungi were 8.15 and 1.13, respectively. The source of airborne bacteria was not outdoors but indoors. GM of airborne bacteria and fungi were 217.6, 291.8 CFU/m3 in the case''s home and 162.0, 415.2 CFU/m3 in the control''s home respectively. The difference in fungal distributions between case and control were significant ($p = 0.004$) and the odds ratio was 0.996 ($p = 0.027$). Atopy was significantly associated with type of house (odds ratio = 1.723, $p = 0.047$) and income (odds ratio = 1.891, $p = 0.041$). Some of the potential allergic fungal genera isolated in homes were Cladosporium spp., Botrytis spp., Aspergillus spp., Penicillium spp., and Alternatia spp. Conclusions This study found that the only distributions of fungal concentrations among possible microbial factors at the indoor environments were significant different according to atopic condition of children. The further research is needed to establish the relationship between bioaerosol exposure and allegic disease.

Abstract Number	**O-1-40-06**
Presenter	Juha Pekkanen*, Pirkka Kirjavainen, Michael Sulyok, Martin Täubel, Anne Karvonen, Rudolf Krska, Anne Hyvärinen
Exposure	microbial environment
Health domains	respiratory disease
Type of research	cohort study

Microbial toxins in residential indoor environment

Background:Toxic secondary microbial metabolites have been suggested to contribute to the adverse respiratory effects of mold and moisture damage. Aims: The aim of this study was to comprehensively characterize the presence of microbial metabolites in residential floor dust and study associations with moisture damage and the respiratory symptoms. Methods: Vacuumed living room floor dust samples from 95 homes of one year old LUKAS2 birth cohort children were analyzed using LC-MS/MS methodology validated for the detection of 330 microbial metabolites. The houses were inspected by civil engineer at early age and 14 out of 95 had major moisture/mold damage in living room or kitchen. 14 children developed doctor diagnosed asthma or repeated asthmatic bronchitis by the age of 6 years. Results: In total, 42 different secondary metabolites were detected, although at low levels (ng/g). Up to 29 metabolites were detected in one house, 17 on average and 6 of the metabolites were present in all houses. Neither sum of concentrations nor total number of secondary metabolites were associated with moisture/mold damage or risk of doctor diagnosed asthma/asthmatic bronchitis. There was a suggestion ($p<0.2$) that the presence of 10 different metabolites were positively and 1 negatively associated with moisture/mold damage, although most lacked dose-response. In unadjusted analyses, 2 metabolites were positively and 2 negatively associated ($p<0.2$) with the risk of asthma/asthmatic bronchitis. Conclusions: Toxic fungal metabolites are ubiquitously present in residential floor dust even without any signs of moisture/mold damage. High overall levels of toxic metabolites in house dust appeared to be a poor indicator of the severity and potential respiratory health hazard of mold/moisture damage, while the role of specific metabolites remains to be confirmed.

Abstract Number	**O-1-41-01**
Presenter	Anne Starling, Stephanie Engel, David Richardson, Julie Daniels, Alison Stuebe, Line Haug, Kari Klungsøyr, Quaker Harmon, Rolv Skjærven, Merete Eggesbø, Matthew Longnecker*
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	case-control study

Perfluoroalkyl substances in mid-pregnancy and preeclampsia in the Norwegian Mother and Child Cohort Study

Background: Perfluoroalkyl substances (PFASs) are widespread and persistent environmental pollutants detectable in the blood of most humans. A recent study panel (http://www.c8sciencepanel.org) described a probable link (implying causality) between perfluorooctanoic acid (PFOA) and pregnancy-induced hypertension among relatively highly exposed women, raising questions about associations in populations that experience lower exposure levels, and associations between other PFASs and pregnancy-induced hypertension. Aim: To estimate associations between plasma concentrations of seven PFASs measured during pregnancy and validated preeclampsia diagnosis among Norwegian women. Methods: A case-cohort study was nested within the Norwegian Mother and Child Cohort Study (MoBa). Eligible pregnancies were singleton births to women who enrolled from 2003-2007, with no previous live births or stillbirths. We selected 307 preeclampsia cases, and 357 pregnancies without regard to case status (subcohort). Case diagnosis was validated by medical record review. Plasma samples were obtained at mid-pregnancy and analyzed for 19 PFASs. Weighted Cox proportional hazards models, adjusted for maternal age, pre-pregnancy body mass index, education, and smoking, were used to estimate hazard ratios (HR) for preeclampsia. The time scale was weeks of gestation to account for varying length of pregnancies. Results: Seven of the 19 PFASs analyzed were detectable in plasma from >50% of the study population. None of these seven PFASs were positively associated with preeclampsia. The HR for the highest quartile of PFOA versus the lowest quartile was 1.2 (95% CI=0.7, 1.9) in adjusted models. The highest quartile of perfluoroundecanoic acid was inversely associated with preeclampsia in adjusted models (HR=0.5, 95% CI=0.3, 0.8). Conclusions: PFAS concentrations during pregnancy were not associated with elevated hazard ratios for preeclampsia among Norwegian women with background levels of PFAS exposure.

Abstract Number	**O-1-41-02**
Presenter	Kristian Tore Jørgensen*, Ina Specht, Virissa Lenters, Lars Rylander, Bo A.G. Jönsson, Aleksander Giwercman, Dick Heederik, Gunnar Toft, Jens Peter Bonde
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Perfluorinated compounds and time to pregnancy in couples from Greenland, Poland and Ukraine

Perfluorinated compounds and time to pregnancy in couples from Greenland, Poland and Ukraine Background Exposure to perfluorinated compounds (PFC) has been suggested to adversely affect human fecundity through longer time to pregnancy (TTP). Aim We assessed the relationship between four PFCs and TTP in populations of pregnant women from Greenland, Poland and Ukraine. Methods We measured blood levels of perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorhexane sulfonic acid (PFHxS) and perfluorononanoic acid (PFNA). Study participants were grouped in country- and PFC-specific tertiles according to individual levels of PFCs. We used Cox discrete-time models to estimate fecundability ratios (FR) comparing TTPs for women in the medium and highest tertiles of PFC levels with TTPs for women in the lowest tertiles. All together 946 women were included. We adjusted for country, maternal age, smoking and body mass index, and prior use of birth control. Unplanned pregnancies were excluded. Results FRs were slightly reduced for women with PFC levels in the medium and highest tertiles compared to the lowest tertiles suggesting a prolonged TTP for women with increased PFC levels. Especially for PFOS, the overall FRs for women with medium [FR=0.81; 95% confidence intervals (CI) 0.67-0.98] and high (FR=0.90; 95% CI 0.74-1.09) levels of PFOS were reduced compared to women with low levels. Similarly for PFNA, women with medium (FR=0.80; 95% CI 0.66-0.96) and high levels (FR=0.84; 95% CI 0.69-1.02) had longer TTPs. However, generally there was no dose-response relationship between increasingly higher PFC levels and longer TTPs and findings were somewhat inconsistent across the study populations from Greenland, Poland and Ukraine. Conclusion These results do not unambiguously support longer TTPs in women with higher PFC levels. The relationship is not straightforward and the lack of a dose response relationship and inconsistency between study populations warrants cautious interpretation.

Abstract Number	**O-1-41-03**
Presenter	Cheryl Stein*, David Savitz
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

PERFLUOROOCTANOATE EXPOSURE AND MATERNAL REPORT OF BIRTH DEFECTS

Background Perfluorooctanoate (PFOA) is found in maternal and umbilical cord blood, amniotic fluid, and breast milk. Toxicology studies demonstrate that PFOA may impact growth and development. To date, no published epidemiological studies have examined the association between PFOA exposure and birth defects. Aims We examined the association between in utero PFOA exposure estimated from environmental and pharmacokinetic modeling and maternal report of birth defects. Methods We used data from the C8 Health Project, a 2005–2006 survey in a Mid-Ohio Valley community highly exposed to PFOA through contaminated drinking water, to examine the association between estimated in utero PFOA levels and maternal report of birth defects among 18,898 liveborn singletons from 1980 – 2005. This community was highly exposed to PFOA, but exposure to other perfluorinated compounds reflected typical background levels. Poisson regression models using generalized estimating equations to account for multiple births to the same woman during the study period were adjusted for birth year, maternal age, parity, maternal race/ethnicity, maternal education, maternal smoking, and child sex. Results At the time of pregnancy, on average women were 25 years old and 45% were nulliparous. At study enrollment, 40% of women had at least some college education, 32% smoked cigarettes, and the mean PFOA concentration was 55.7 ng/mL (standard deviation (SD) 164.3; interquartile range (IQR) 32.3). There were 333 maternal reports of major congenital anomalies, a prevalence of 17.7%. The most commonly reported defects were gastrointestinal, heart, limbs, brain, and kidney. Conclusions Using these data, we will present associations between estimated in utero PFOA exposure and maternal report of birth defects.

Abstract Number	**O-1-41-04**
Presenter	Marina Vafeiadi*, Martine Vrijheid, Eleni Fthenou, Georgia Chalkiadaki, Panu Rantakokko, Hannu Kirivanta, Soterios Kyrtopoulos, Leda Chatzi, Manolis Kogevinas
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Exposure to organochlorine compounds during pregnancy and birth outcomes in the mother-child cohort in Crete, Greece (Rhea study).

Background: Several organochlorine compounds (OCs), including polychlorinated biphenyls (PCBs) and pesticides are persistent organic pollutants (POPs) that bioaccumulate through the food chain and cross the placenta. OCs have been shown to be developmental toxicants in animal experiments but the epidemiological evidence on pregnancy outcomes is inconsistent. Aims: We examined whether in utero exposure to 11 different OCs is associated fetal growth and gestational age in 1117 mother-child pairs of a prospective mother-child cohort in Greece. Methods: Concentrations of several PCBs and organochlorine pesticides (p,p-dichlorodiphenyl dichloroethene [p,p-DDE], p,p-dichlorodiphenyl trichloroethane [p,p-DDT], tetra-bromodiphenyl ether [BDE-47], and hexachlorobenzene [HCB]) were determined in 1st trimester maternal serum by gas chromatography high resolution mass spectrometry. We constructed an overall exposure score based on the concentrations of each of four POPs or groups of POPs (HCB, DDE, BDE-47 and ΣPCBs) that took values from 0 (all chemicals below the median) to 4 (all chemicals above). Multiple linear regression models were used to investigate the associations with birth weight, gestational age, and head circumference. Results: A significant decrease in birth weight was observed for increasing levels of HCB (adjusted β= −72.5 g; 95% CI:-131.6 to -13.5) and ΣPCBs (adjusted β= -72 g; 95% CI:-141.5 to -2.4). These results were more pronounced in girls. A one-unit increase in the overall exposure score was also associated with lower birth weight (adjusted β= −30.2 g; 95% CI, −57.7 to −2.7). Small, negative but not statistically significant associations were observed between OCs, gestational age and head circumference. Conclusions: The findings suggest that prenatal exposure to PCB and HCB impairs fetal growth and add to the growing literature that demonstrates an association between low-level organochlorine exposure and fetal growth.

Abstract Number	**O-1-41-05**
Presenter	Juan P. Arrebola*, Mariana F. Fernandez, Piedad Martin-Olmedo, Nicolas Olea
Exposure	persistent organic pollutants
Health domains	equity
Type of research	exposure modeling

Human exposure to p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) in urban and semi-rural areas in southeast Spain: A gender perspective

Background p,p'-Dichlorodiphenyldichloroethylene (p,p'-DDE) is the main metabolite of pesticide dichlorodiphenyltrichloroethane, which was widely used in agriculture and public health from the 1940s until the 1970s. However, an estimated 4-5,000 metric tons of DDT per year are still used worldwide, mainly for disease vector control. p,p'-DDE is considered a persistent organic pollutant with potential adverse effects on human health. There are considerable knowledge gaps concerning the influence of gender on p,p'-DDE exposure. Previous reports have indicated that men and women can experience substantially different internal exposure to environmental pollutants even when exposed to similar external levels. Aims The aims of the present study were to assess p,p'-DDE levels in serum and adipose tissue from a cohort of adults in southern Spain and to explore the predictors of exposure from a gender perspective. Methods The study population (n = 387) was intraoperatively recruited in two areas of Granada Province (southern Spain), and data on potential predictors of these concentrations were gathered by questionnaire. A 5-10 g sample of adipose tissue and 10 mL of blood were collected during surgery. Chemical analyses were performed using gas chromatography–coupled mass spectrometry in tandem mode. Independent variables were gathered using an ad hoc questionnaire. The statistical analysis was performed by means of multivariable linear regression models. Results All participants showed detectable concentrations of p,p'-DDE in both serum and adipose tissue, with median concentrations of 175.7 and 93.0 ng/g lipid, respectively ($p < 0.001$), and the two measurements showed positive correlations. Women showed higher concentrations than men (115.8 and 66.2 ng/g lipid, respectively, $p < 0.001$). Concentrations in both matrices were positively associated with fatty food consumption, as well as with age and BMI, the latter only in adipose tissue. The multivariate model showed that, among women, adipose tissue concentrations were approximately 40% higher in those residing in the semi-rural area and 2-fold higher in those whose mothers had participated in agricultural activities during the pregnancy. Conclusions In this study population, gender and place of residence play a key role in human exposure to p,p'-DDE and can be used to identify subjects at special risk of long-term exposure.

Abstract Number	**O-1-41-06**
Presenter	Philippe Grandjean*, Ulla Brasch Mogensen, Esben Budtz-Jørgensen, Pal Weihe, Carsten Heilmann
Exposure	persistent organic pollutants
Health domains	infectious diseases
Type of research	cohort study

Decreased Serum Vaccine Antibody Concentrations as Critical Outcome of Exposure to Perfluorinated Compounds

Background: Experimental toxicology studies suggest that immunotoxicity may occur at low-level exposures to perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), two persistent contaminants of food, drinking water, and a variety of consumer products. Aims: To determine the association of PFC exposure with antibody response to childhood vaccinations. Methods: In a prospective study of a birth cohort from the National Hospital in Faroe Islands, 656 consecutive singletons were recruited at birth, and 459 were examined at age 7 years. Serum was analyzed for PFOS and PFOA and for specific antibody concentrations against tetanus and diphtheria toxoids. A total of 412 children also had a serum analysis at age 5 years. Multiple regression analysis and structural equation models were used to determine the association between exposures and antibody concentrations. Benchmark dose calculations were carried out to compare the findings with current exposure limits. Results: PFOS and PFOA measured at ages 5 and 7 years showed strong negative associations with antibody concentrations at age 7 years. When both were included in a structural equation model, a doubled exposure was associated with differences of -59% (95% CI: -23%, -78%) and -65% (-30%, -82%) in diphtheria and tetanus antibody concentrations, respectively. Further analyses suggested that cumulated exposures measured both at age 5 and 7 contributed to the associations and that they could not be reliably attributed to any single compound. Using different dose-effect assumptions, benchmark dose levels were found to be about 1.3 ng/mL for PFOS and 0.3 ng/mL for PFOA at a benchmark dose response of 5%. Conclusions: These findings suggest that immunotoxicity may be a critical effect of human exposure to perfluorinated compounds, and that antibody response to childhood immunizations is a useful and relevant outcome. The strong associations observed are remarkable, and the calculated benchmark dose levels suggest that current exposure limits for PFOS and PFOA may be as much as 1000-fold too high.

Abstract Number	**O-1-42-01**
Presenter	Rachel Smith*, Mark J Nieuwenhuijsen, Susan C Edwards, James E Bennett, John Wright, Nicky Best, Mireille B Toledano
Exposure	drinking water
Health domains	reproductive outcomes
Type of research	cohort study

Exposure to trihalomethanes in drinking water during pregnancy and risk of adverse fetal growth outcomes in the Born in Bradford birth cohort.

Background and Aims: Evidence for a relationship between trihalomethane (THM) exposure and adverse fetal growth outcomes remains inconsistent, even with the incorporation of individual water use into exposure assessment in the most recent studies. We are investigating maternal exposure to THMs during pregnancy and risk of adverse fetal growth outcomes in the Born in Bradford (BiB) birth cohort. BiB is a large multi-ethnic prospective birth cohort which recruited 12453 pregnant women between 2007 and 2010 in Bradford (England). Methods: Pregnant women (N=11129) reported their water consumption and filtering, showering, bathing, and swimming via questionnaire at 28 weeks gestation. Modelled monthly THM concentrations at water supply zone level, mother's individual water use, and THM uptake factors into blood are combined to estimate integrated internal THM uptake (µg/d). We will examine the relationship between integrated THM uptakes, and continuous birth weight, term low birth weight and small for gestational age (SGA), controlling for a range of factors including ethnicity, smoking, and deprivation. Results: Preliminary exposure assessment for a subset (N=2710 mothers) indicates mean integrated uptake of total THMs to be 1.89 µg/d (SD 1.91) and total brominated THMs to be 0.26 µg/d (SD 0.24). Over 90% of THM exposure variability is attributable to individual variability both for total and individual THMs, dwarfing temporal and spatial variability components. Combined showering and bathing is responsible for 79% and 90% of total THM and total brominated THM uptake respectively. Full results on the association between THM exposure and fetal growth outcomes will be presented. Conclusion: Exposure assessment is being extended to all mothers with individual water use data. This will be the largest study to date on THMs and fetal growth outcomes to incorporate individual level water use data into exposure assessment and to use integrated THM uptakes, and the results will make a major contribution to the evidence-base on THMs and reproductive health.

Abstract Number	**O-1-42-02**
Presenter	Susan C Edwards*, Nicky Best, Rachel Smith, Emily Petherick, John Wright, Mark J Nieuwenhuijsen, Mireille B Toledano
Exposure	drinking water
Health domains	reproductive outcomes
Type of research	cohort study

Haloacetic acids in public drinking water and risk of adverse birth outcomes in the Born in Bradford cohort

BackgroundDisinfectants such as chlorine react with natural organic matter in drinking water to produce disinfection by-products such as trihalomethanes (THMs) and haloacetic acids (HAAs). Evidence to date suggests a possible association between THMs and small for gestational age (SGA). To date, there are limited data available with which to assess any potential effects on reproductive health of exposure to HAAs. Here we explore HAA concentrations in public water supplies and drinking water patterns amongst the Born in Bradford (BiB) cohort. BiB is a large multi-ethnic prospective birth cohort study which recruited 12,453 women between 2007-2010 in Bradford, England. AimsTo investigate the relationship between HAA exposure estimates during pregnancy and risk of adverse fetal growth outcomes in BiB, taking into account detailed individual level information on potential confounders. MethodsTo estimate an individual's exposure to HAAs in public drinking water, we combined observed HAA concentrations measured at the tap and modelled in space and time, with water use questionnaire information collected at recruitment (~26-28 weeks). We analysed low birth weight (LBW), term LBW (≥37 weeks gestation) and SGA outcomes. Confounders include smoking, alcohol consumption, maternal weight and height, parity, ethnicity, and IMD 2010 as an index of deprivation. ResultsBiB women drink on average 1.7 (±0.9) L/day of tap water. They are exposed to averages of 8.9 (±2.2) µg/L dichloro-, 12.5 (±2.7) µg/L trichloro- and 1.3 (±0.5) µg/L bromodichloro-acetic acids based on water supplies serving their residence. 7.5% of singleton births were LBW, of which 50% at term. 1,270 babies were born SGA, of which 66% were SGA but not LBW. Full results on the adjusted association of HAA exposure and fetal growth outcomes will be presented. ConclusionThe results of this first study on the effect of HAAs on growth restriction in utero in a large British population will make a major contribution to the evidence-base on HAAs and reproductive health.

Abstract Number	**O-1-42-03**
Presenter	James VanDerslice*, Janice Panichello, Christina Porucznik, Marissa Taddie
Exposure	drinking water
Health domains	reproductive outcomes
Type of research	others

Comparison of Individual-level and Ecologic Studies of the Association of Drinking Water Contaminants on Adverse Birth Outcomes

Background Several epidemiological studies of the effects of drinking water contaminants have used ecologic designs, comparing groups defined by the community water system that they use. While ecologic studies are subject to bias, the degree of bias has rarely been assessed. Aims The aim of this analysis was to assess the bias from the use of ecologic study designs by comparing results from an individual-level study and an ecologic study of the association of arsenic in drinking water to adverse birth outcomes. Methods Maternal addresses at time of delivery were geocoded for over 651,000 live births (1989–2006) in the state of Utah, USA. Annual average arsenic levels were estimated for 476 Community Water Systems using water quality monitoring data. Arsenic levels were assigned to each birth by linking geocoded addresses to georeferenced water system service areas. Logistic regression was used to estimate the associations between individual arsenic levels and the occurrence of low birth weight (LBW), small for gestation age (SGA), pre-term and very preterm birth. For the ecologic study negative binomial regression was used to assess the relationship between annual average arsenic levels for each community water system and the proportion of births that were LBW, SGA, pre-term or very pre-term. Results There were significant associations between arsenic levels and the risk of LBW and SGA in both the individual-level and ecologic studies. Drinking water arsenic levels of 5 to <10 µg/L were associated with LBW in the individual-level study (aOR=1.18; 95% CI 1.06, 1.32) and in the ecologic study (IRR=1.09; 95% CI 1.00, 1.19). There were no significant associations with pre-term or very pre-term in either analysis. Conclusions Results from the ecologic study were comparable with results from an individual-level study of the effects of arsenic on LBW and SGA. This work was supported by the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Program (contract number 200-2010-37353).

Abstract Number	**O-1-42-04**
Presenter	Rosana Weldon, William Neal, Collin John, Christa Ice, Lorna Gibson, Brenda Eskenazi, Tony Fletcher*
Exposure	drinking water
Health domains	cardiovascular disease
Type of research	cross-sectional study

In utero PFOA and high blood pressure among pre-adolescent children in West Virginia

Background: Perfluorooctanoic acid (PFOA) has been associated with increased risk of raised cholesterol and pregnancy induced hypertension. No studies have examined associations between PFOA and blood pressure in children either cross-sectionally or in relation to in utero exposure. Aims: Our objective was to examine associations between prenatal exposure to PFOA and high systolic and/or diastolic blood pressure in 5th grade children. Methods: Participants (n=196, aged ~9-12 years) were exposed to PFOA via drinking water in their communities and were members of both the C8 science panel and the Coronary Artery Risk Detection in Appalachian Communities (CARDIAC) studies. We performed a cross-sectional analysis of in utero PFOA, estimated from maternal serum measured in 2005-6, and blood pressure dichotomized at the 90th percentile for age, sex and height. High combined blood pressure was defined as having either high systolic or diastolic blood pressure. Results: Median (25th, 75th percentile) in utero PFOA was 6.7 (4.4, 12.4) ng/ml. In preliminary analysis we found that increased in utero PFOA was associated with increased odds of high blood pressure in children with stronger associations for high diastolic (OR=1.8, 95% CI=1.0-3.0) than high combined blood pressure (OR=1.5, 95% CI=0.9-2.5) or high systolic (OR=1.3, 95% CI=0.7-2.4). Conclusions: In utero PFOA may be associated with elevated blood pressure in children exposed while in the womb. However study power is limited and these results need confirmation.

Abstract Number	**O-1-42-05**
Presenter	Joseph Sambali*, Joseph Sambali, Ann Le Mare, Chris Dunn
Exposure	drinking water
Health domains	infectious diseases
Type of research	cross-sectional study

Understanding health related behaviours and beliefs in north-west Tanzania: environmental health knowledges and coping strategies

Background: This article draws on a socio-cultural perspective to analyse public perceptions of health risks, which are based on complex interactions between social and cultural factors within a particular social space. This approach challenges traditional bio-medical and scientific approaches to understanding health related behaviours. The article discusses how local communities perceive risks, and draws out the important distinction between ‘risk’ (the event) and vulnerability (the social context of that risk), providing a justification for the socio-cultural approach to health. This exploration then leads into a discussion of knowledge, or information, assumptions and judgements that inform health related decisions. Aim: To explores the way people make sense of of environmental health risks based on experiences. We address the following research questions: (1) What are the perceptions and beliefs of rural citizens regarding factors that produce or prevent health? (2) How is the socio-cultural perspective important in understanding and theorizing environmentally related health? Methodology: Ethnographic research including participant observation, focus groups and in-depth interviews. Analysis and interpretation of data employed ground theory based on emergent themes. Results and conclusions: Generally, results show that individuals respond purposeful so that to safeguard their social and cultural values. In order to achieve that villagers use different approaches such as comparative judgement (compare themselves with more resilient individuals or animals); fatalism (when challenges are felt inevitable), and internalising risks (a sense of personal or social invulnerability). Our finding sheds light on why local people sometimes reject, ignore or manipulate health interventions in a manner that seems, from an external scientific perspective, to be ‘illogical’.

Abstract Number	**O-1-42-06**
Presenter	Patrick Levallois*, Molière Nguile-Makao, Nathalie Bernard, Yves Giguère, Manuel Rodriguez, Robert Tardif, Sylvie Marcoux, Alexandre Bureau
Exposure	water
Health domains	reproductive outcomes
Type of research	case-control study

Drinking Water Chlorination By-Products and Intra-Uterine Growth Restriction: is there an effect modification of the CYP2E1 G1259C gene polymorphism?

Background. Genetic polymorphisms could interact with disinfection by-products metabolism and increase their toxicity which may result in an increased risk of intrauterine growth restriction (IUGR). Aim. To evaluate whether the single nucleotide polymorphism (SNP) rs3813867 (G1259C) of CYP2E1 gene modifies the relationship between IUGR and trihalomethanes (THMs) exposure during pregnancy as previously reported by Infante-Rivard (2004). Methods. The design and THMs exposure of our population-based case-control study were presented recently (Levallois et al, 2012). Cases were term single neonates with birth weight <10th percentile of the age- and sex-specific Canadian birth weight distribution. Three controls (birth weight >10th percentile) per case were chosen among births from the same calendar week. Exposure of mothers during the last trimester of pregnancy was based on intensive monitoring of DBPs of the water distribution systems serving the residences and a phone questionnaire of mothers two months after birth. DNA samples of infants and mothers were extracted from either blood or saliva samples. SNPs were genotyped with a multiplexed PCR reaction (MassARRAY SNP Multiplex Sequenom). Non-caucasian infants were excluded from the analysis. Odds Ratios (OR) were estimated by a non-conditional logistic regression on infant and mother genotype. Risk factors for IUGR were included in the model. Results. SNP genotypes were available for 298 cases and 1182 controls and their mothers. For total THMs ≥ 80µg/L, the adjusted OR for children with 1 or 2 variant alleles of CYP2E1 G1259C was estimated at 3.44 (95% CI: 0.63-18.57) in comparison with 1.20 (95%CI:0.80-1.73) for the wild type group (p value for interaction=0.325). Conclusion. We did not observe any significant effect modification of the CYP2E1 G1259C SNP on the association between DBP exposure and IUGR.

Abstract Number	**O-2-07-02**
Presenter	Bettina Menne*, Zhanat Varakina
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

The public health consequences of climate change in the Russian North

The public health consequences of climate change in the Russian North Authors: Varakina ZhL, Grjibovski AM, Pshenichnaya NY, Yurasova ED, Menne B. Background/Introduction: Throughout the 21st century all climate models, without exception, have anticipated warming across northern Russia. The increase in yearly air temperature in the circumpolar zone of Northern Russia over the last few decades has almost doubled the global average. Aim: The aim of this study was to assess the health effects of climate change in the Arkhangelsk Region (AR) of the Russian Federation (RF), identify action points to strengthen the prevention of health effects from climate change and to develop a regional adaptation strategy. Methodology: A health vulnerability assessment was carried out, utilizing official statistical data (disease incidence, mortality rate, temperature) and standardized methods of statistical analysis (correlation and dispersion analysis, Poisson, binomial and linear regression, time-series analysis). Findings: Temperature dependencies were defined for ischemic heart disease (IHD), respiratory tract diseases and external causes in two age groups and for cerebrovascular diseases. An increase of ambulance calls in summer time was observed. A 5-10% increase in the incidence of salmonellosis was observed for every one degree increase in the mean weekly temperature. An almost 60- fold increase of tick-borne encephalitis (TBE) incidence was observed, since 1980. Due to permafrost melting, the accessibility of reindeer breeding families in the Nenets Autonomous District is delayed by more than eight weeks during the last two decades. Conclusion: Health vulnerability assessments are a useful mechanism to support the development of robust action plans to strengthen the prevention of health effects from climate change. Regional adaptation strategies, developed in response to mapped need, offer the potential to improve the resilience, capacity and capability of health services to respond to population need

Abstract Number	**O-2-07-03**
Presenter	SatByul Estella Kim*, Ho Kim, Jungah Yoo
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Health Vulnerability Assessment of Heat waves in Korea

Background and aims: Heat waves are well known to be associated with increases in mortality and the burden of heat-related illness in population. The health effects due to heat waves appear differently depending on the population characteristics and regions. However, there is limited regional information available to guide the public health adaptation plan and climate change decision-making. Therefore, regional health vulnerability of heat waves is assessed in this study. Methods: Health vulnerability related to heat waves is determined based on three components; climate change exposure, sensitivity and adaptive capacity. Vulnerability index (VI) for each region was calculated based on values of 19 variables identified for three components with weights from Delphi consensus of experts. VI was mapped for entire Korean peninsula from 2000s to 2100s, applying SRES A1B and RCP scenarios with assessment units of 232 local governments and results units of 16 aggregated areas. The contribution analyses of VI were performed to grasp contributable variables. Results: Climate change vulnerabilities related to heat waves showed large regional variations. Contribution of three components, climate change exposure, sensitivity and adaptive capacity, were 0.33, 0.28 and 0.28 respectively. VI was highly associated with socio-demographic characteristics and healthcare access conditions. Vulnerable areas are mostly distributed southern part of Korea in 2000s, and tend to be gradually moving northward as time goes by. Currently vulnerable areas appear to stay or be more vulnerable in the future. Conclusions: Overall vulnerability is predicted to be increasing over time. It is important to consider spatial data within a single country when evaluating climate change vulnerability for identifying cost-effective intervention and early planning of public health adaptation strategies.

Abstract Number	**O-2-07-04**
Presenter	Jianyong Wu, Ying Zhou, Yang Gao, Joshua Fu, Brent Johnson, Cheng Huang, Youngmin Kim, Yang Liu*
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Uncertainties in estimating future heat wave mortality in the eastern U.S.

Aims. We estimated the future heat wave mortality in the eastern United States (~ 1,700 counties) under two Representative Concentration Pathways (RCPs) and analyzed the sources of uncertainties. Methods Using dynamically downscaled hourly temperature projections in 2057-2059, we calculated heat wave days and events based on four heat wave metrics, and estimated the excess mortality attributable to them. The sources of uncertainty in estimated excess mortality were apportioned using a variance-decomposition method. Results In the eastern U.S., the excess mortality attributable to heat waves could range from 200-7,807 with the mean of 2,379 persons/year in 2057-2059. The projected average excess mortality in RCP 4.5 and 8.5 scenarios was 1,403 and 3,556 persons/year, respectively. Excess mortality would be relatively high in the southern and eastern coastal areas. The major sources of uncertainty in the estimates are relative risk of heat wave mortality, the RCP scenario, and the heat wave definitions. Conclusions The estimated mortality risks from future heat waves are likely an order of magnitude higher than its current level and the probability of catastrophic outcomes with thousands of deaths each year is not trivial under the RCP 8.5 scenario. The substantial spatial variability in estimated county-level heat mortality suggests that effective mitigation and adaptation measures should be developed based on spatially resolved data.

Abstract Number	**O-2-07-05**
Presenter	Sotiris Vardoulakis*, Clare, H. Heaviside, Andy Haines, Shakoor Hajat, Mathew Heal, Roy Kennedy, Jolyon Medlock, Gordon Nichols, John O'Hagan, Carla Stanke, Bernd Eggen
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Health effects of climate change in the UK – current evidence and research gaps

Scientific consensus generally indicates that climate change is likely to cause a range of direct and indirect effects on human health in developing and developed countries. We reviewed the scientific evidence on the health effects of climate change in the UK in the light of the 2009 UK Climate Projections. We focused on the effects of temperature and heatwaves, floods, air pollution, aeroallergens, vector-borne diseases, airborne, water and food-borne diseases, and UV radiation exposure on public health. Literature reviews were conducted on these topics to identify climate-sensitive health outcomes, population exposure patterns, exposure-response relationships (where possible), and vulnerable populations and areas in the UK. Quantitative health impact assessment methods were used to estimate the effect of current and future temperatures and air pollution (ground-level ozone) on population health under a range of scenarios. In addition, the impacts of climate change in the indoor environment, and the trade-offs between indoor air quality and energy efficiency measures were discussed. Furthermore, health co-benefits from policies to reduce greenhouse gas emissions were illustrated with examples from the household energy, urban transport, electricity generation, and food and agriculture sectors. Despite uncertainties in the analysis, this paper provides strong evidence indicating that climate change is likely to act as a risk modifier aggravating existing public health problems (heat and flood related deaths, air pollution, allergies, mental health, health inequalities, etc.) in the UK. Research gaps in epidemiological evidence, environmental exposure assessment, disease surveillance, and evaluation of public health interventions (e.g. early warning systems for heatwaves, air pollution, pollen and floods) will be identified and discussed in this context.

Abstract Number	**O-2-07-06**
Presenter	Jouni Jaakkola*
Exposure	climate change (temperature)
Health domains	ethics
Type of research	review

Climate Change, Limits to Growth and Public Health – Concerns for Global Ethics (e*)

Forty years ago, the Club of Rome published a groundbreaking report, The Limits to Growth (Meadows et al. 1972). The report presented possible future scenarios about human consumption of resources and suggested that, according to the business-as-usual scenario, mankind was consuming more than nature was capable of providing, which would lead to global economic collapse by 2030. The overall scenario was based mainly on predictions of remaining non-renewable resources, food production per capita, services per capita, industrial output per capita, population growth and production. Global pollution was also considered as a limiting factor for growth. Innovative developments, especially in technology and agriculture in the 1980s and 1990s, raised doubts about the relevance of the Club of Rome concerns, and the warnings were essentially ignored. In the1990s, discussion about anthropogenic atmospheric pollution and greenhouse gas production leading to climate change with serious ecological effects opened new perspectives to discussion about LTG. One of the most important contributions of the original report was the introduction to systems analysis at the global level. Potential health consequences of climate change were first discussed among environmental epidemiologists in the 1996 ISEE conference in Edmonton. The application of epidemiologic methods in the assessment of climate change health effects were discussed in the ISEE Ethics and Philosophy Committee's symposium in Dublin in 2009. Direct and indirect health effects of climate change have increasingly become mainstream in epidemiologic enquiry. The 25th ISEE meeting in Basel will include the symposium Limits to Growth and Public Health and there will be several research sessions where results on direct and indirect health and social effects of climate change are presented. The purpose of the designated ethics discussions in these sessions is to reflect on epidemiologic findings and their ethical implications and within the larger global framework of the limits to growth.

Abstract Number	**O-2-09-01**
Presenter	Rob Beelen*, Gerard Hoek, Ole Raaschou-Nielsen, Klea Katsouyanni, Kees de Hoogh, Ming-Yi Tsai, Paolo Vineis, Bert Brunekreef
Exposure	ambient air pollution
Health domains	other
Type of research	meta-analysis

Natural cause mortality and exposure to elemental composition of particulate matter: an analysis of 19 European cohorts within the multi-center ESCAPE project

Background Studies have shown associations between mortality and long-term exposure to particle mass air pollution. Studies on the effects of the elemental composition of particulate matter are, however, limited. Aims To study the association between natural cause mortality and long-term exposure to the elemental composition of particulate matter within the multi-center European Study of Cohorts for Air Pollution Effects (ESCAPE) project and the Transport related Air Pollution and Health impacts (TRANSPHORM) project. Methods Data from 19 European cohort studies were used. Residential exposure was characterized following a strictly standardized protocol as annual average concentrations of Copper (Cu), Iron (Fe), Potassium (K), Nickel (Ni), Sulphur (S), Silicon, (Si), Vanadium (V) and Zinc (Zn) within PM size fractions <2.5µm (PM2.5) and <10µm (PM10), estimated using land-use regression (LUR) models. Cohort-specific statistical analyses of the associations between mortality and air pollution were conducted using Cox proportional hazards models using a common protocol followed by meta-analysis. Results The total study population consisted of 322,159 participants, of which 27,208 died from a natural cause during follow-up. Elevated risks were shown for all elements with significantly elevated hazard ratios for: S PM2.5 (1.15 (95% CI: 1.06-1.25) per 200 ng/m3); Si PM2.5 (1.09 (95% CI: 1.01-1.18) per 100 ng/m3); and Ni PM10 (1.10 (95% CI: 1.01-1.21) per 2 ng/m3). No heterogeneity between individual cohort effect estimates was found for these significant associations. Conclusions Long-term exposure to elemental composition of particulate matter was associated with natural cause mortality.

Abstract Number	**O-2-09-02**
Presenter	Sara Adar*, Jennifer D'Souza, Kari Mendelsohn-Victor, Lianne Sheppard, Mary Cushman, Ana V. Diez-Roux, David Jacobs, Joel Kaufman, Timothy Larson
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Long-Term Concentrations of Airborne Coarse Particulate Matter and Systemic Inflammation/Coagulation in the Multi-Ethnic Study of Atherosclerosis (MESA)

Background Little is known about the long-term health impacts of coarse particulate matter (PM10-2.5) though past findings link PM10-2.5 exposure to inflammatory and coagulatory responses. Aims We investigated cross-sectional relationships between long-term PM10-2.5 mass, copper, zinc, silicon and phosphorous levels and a summary measure of inflammation/coagulation. Methods This analysis used data from 2,024 Multi-Ethnic Study of Atherosclerosis participants (aged 45-84 yrs) from Winston Salem, NC, Chicago, IL, and St Paul, MN. Spatial prediction models were used to predict 3-year average concentrations based on cohort-specific air pollution measurements and geographic data. Measured levels of C-reactive protein, interleukin-6, fibrinogen, and d-dimer in blood at the baseline exam were summarized into a composite measure based on Z-scores. Linear regression was used to estimate associations while controlling for confounders including demographic variables, health behaviors, BMI, and metropolitan area. Component models also controlled for PM10-2.5 mass and sensitivity analyses controlled for fine particles (PM2.5). Results Positive but non-significant associations were observed between our composite score and PM10-2.5 mass (0.06 per 2 µg/m3, 95% CI: -0.1,0.3), copper (0.1 per 4 ng/m3, 95% CI: -0.2,0.4), zinc (0.1 per 11 ng/m3, 95% CI: -0.04,0.4), phosphorous (0.1 per 6 ng/m3, 95% CI: -0.2, 0.4), and silicon (0.2 per 0.1 µg/m3, 95% CI: -0.02,0.5). Control for PM2.5 attenuated these associations, however, and results within and between individual markers were inconsistent. The strongest and most consistent results were for d-dimer with 5.8% (95% CI: -0.8, 12.3), 17.0% (95% CI: 4.8, 29.1), and 8.7% (95% CI: 0.8, 16.7) larger levels for 2 µg/m3, 4 ng/m3, and 0.1 µg/m3 of PM10-2.5 mass, copper, and silicon, respectively. Conclusions Inconclusive evidence was found for cross-sectional associations between PM10-2.5 and the investigated measures of inflammation/coagulation.

Abstract Number	**O-2-09-03**
Presenter	Elissa Wilker*, Petter L. Ljungman, Itai Kloog, Joel D. Schwartz, Diane R. Gold, Petros Koutrakis, Joseph Vita, Gary Mitchell, Emelia Benjamin, Naomi Hamburg, Murray A. Mittleman
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

The Impact of Long-Term Exposure to Air Pollution on Conduit Artery and Microvascular Function

Background: Long-term exposure to ambient air pollution, including fine particulate matter (PM2.5), has been associated with cardiovascular morbidity and mortality. Impaired vascular responses may in part explain these findings, but few studies have examined chronic effects of long-term exposures incorporating measures of both conduit artery and microvascular function in a large population-based study. Aims: We evaluated the impact of residential proximity to primary or secondary highway (<100m, 100-200m, 200-400m, >400m) and long term exposure to PM2.5 (1-year average) on brachial artery flow mediated dilation (FMD) and reactive hyperemia in the Framingham Offspring and Third Generation Cohorts. Methods: FMD (%) and hyperemic flow velocity (cm/s) were assessed in the Offspring 7th (1998-2001) and Third Generation 1st (2001-2005) exams (n=5,133). We evaluated associations between residential proximity to major roads and spatially resolved estimated PM2.5 from land use and satellite images with FMD and hyperemic flow using linear regression. Results: Compared to living further than 400m from a major road, living within 100m was associated with -0.31% (95% CI: -0.53, -0.09) lower FMD and -1.49 cm/s (95% CI: -2.9,- 0.09) lower hyperemic flow velocity in models adjusted for age, sex, body mass index, smoking status, long-term time trends, season, cohort, and indicators of socioeconomic position. A 1 µg/m3 higher average PM2.5 was associated with -0.09% (95% CI: -0.24, 0.06) lower FMD, and -1.07 cm/s (95% CI: -2.0, -0.12) lower hyperemic flow. Results were not materially altered after further adjustment for potential mediators. The magnitude of estimates for hyperemic flow became stronger when we excluded smokers and participants using antihypertensive or lipid-lowering medications. Conclusions: In a large, community-based cohort, measures of long-term exposure to air pollution were associated with impaired conduit and microvascular function.

Abstract Number	**O-2-09-04**
Presenter	Jaime E. Hart*, Kathryn Rexrode, Jennifer Prescott, Immaculata De Vivo, Francine Laden
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Exposure to ambient air pollution and changes in leukocyte telomere length in US women

Background: Telomeres are repetitive sequences of nucleotides at the end of chromosomes that function to maintain structural integrity. Shorter telomere length has been associated with decreased life-expectancy and increased rates of cardiovascular disease (CVD) and cancer. Ambient air pollution has been related to similar outcomes. A few studies have shown associations between increases in pollution and decreases in telomere length, however fewer have been able to examine the effects of air pollution on longer term changes in telomere length. Aims: We aimed to determine if ambient air pollution exposures were associated with 10 year changes in leukocyte telomere length (LTL) in US women. Methods: Repeated measures of LTL from a real time PCR assay were available for 272 members of the Nurses' Health Study. Blood samples were collected 1989-1990 and again in 2000-2001. Change in telomere length over the 10 year period (and the percent change) was calculated for each woman. Spatiotemporal model predictions were used to determine the average concentrations of PM2.5, PM10, NO2, and SO2 1990-2000 for each participant based on her residential address history. Linear regression with adjustment for known lifestyle predictors of LTL and change in LTL was used to determine the change in LTL for each standard deviation increase in air pollution. Results: In adjusted models, the 10 year average levels of all pollutants were associated with decreases in LTL. However, only associations with PM2.5 and PM10 were statistically significant. Each 6 µg/m3 increase in PM10 was associated with a 4.0% decrease (SE=1.9) in LTL and each 3 µg/m3 increase in PM2.5 was associated with 3.6% (SE=1.8) decrease. Conclusions: Average particulate matter pollution in the 10 years between blood draws was associated with an accelerated rate of telomere length shortening in US women.

Abstract Number	**O-2-09-05**
Presenter	Su Ta-Chen*, Juey-Jen Hwang, Chang-Chung Chan
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Carotid intima-media thickness is associated with long-term exposures to PM10 and PM2.5 among middle-aged adults

Background: The association between long-term exposure to air pollution and carotid intima-media thickness (CIMT) is still inconsistent. Aims: To evaluate the association between one-year averaged exposure of particulate matters (PM) and the CIMT in adults without coronary diseases. Materials and Methods: We enrolled 402 adults aged 35-60 to participate in this study in Taipei, Taiwan during 2009-2011. We used a high-resolution B-mode ultrasonography to measure study subject's CIMT. We applied Land Use Regression models (LUR), which was developed by the European Study of Cohorts for Air Pollution Effects (ESCAPE), to estimate each subject's one-year averaged exposures of traffic-related air pollutants, including PM with diameters less than 10 mm (PM10) and 2.5 mm (PM2.5), and the absorbance of PM2.5 (PM2.5 abs), in urban environment. We applied multivariate linear regression analyses to assess the associations between air pollution exposures and CIMT adjusting for age, gender, systolic blood pressure, low-density lipoprotein cholesterol, body mass index, diabetes mellitus, education, and smoking. Results: Our study subjects with mean age of 47 years were mostly males (85%) with relatively low prevalence of hypertension (21.6%), diabetes mellitus (10.2%) and current smoking (14.4%). Their mean and maximum CIMT of left common carotid artery (CIMTLCCA) was 0.56±0.10 mm and 0.70±0.12 mm respectively. Their one-year averaged exposures ± standard deviations were 54.31± 5.99 μg/m3 for PM10, 28.74± 3.87 μg/m3 for PM2.5, and 2.14 ± 0.36 x 10-5m-1for PM2.5 abs. Multivariate regressions showed average percentage (95% confidence intervals) increase in mean CIMTLCCA was 2.51% (0.47-4.52%) per 5μg/m3 PM2.5, 5.03% (0.60-9.47%) per1.0 × 10-5m-1PM2.5 abs, and 2.69 % (0.05-5.32%) per 10 μg/m3 PM10, respectively. Conclusions: Subclinical atherosclerosis, represented by CIMT, was positively associated with long-term exposures to traffic-related PM2.5, PM2.5 abs, PM10 for middle-aged adults.

Abstract Number	**O-2-09-06**
Presenter	Martina Gandini*, Ennio Cadum, Morena Stroscia, Giuseppe Costa, Moreno Demaria, Gabriella Sebastiani, Gabriele Zanini
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

LONG TERM EFFECTS OF PM2.5 IN ITALY: PRELIMINARY RESULTS OF THE INHISS COHORT STUDY

Background The current understanding of the association between long-term exposure to air pollution and adverse health effect is based on cohort studies from USA, Canada, Japan, China. Few studies have been conducted so far in Europe, with restrictions on age of cohort recruited and with poor geographical variability. Aims To evaluate cause-specific mortality and hospital admission risk in relation to long term exposure to PM2.5 in the whole Italian area. Methods The study is based on a 7-year follow-up of mortality and hospital admission of a cohort of about 130.000 subjects, interviewed in the 2000 National Italian Health Survey, living in 1449 municipalities representative of the Italian population. Exposure to PM2.5 (assessed in 2005 in this preliminary analyisis) derived from modelled data from MINNI project with spatial resolution of 2kmx2Km, with PM2.5 annual mean ranging from 3.7 to 40.8 mg/m3.We used Cox proportional hazard models, controlling for individual data on age, gender, occupational and educational status, BMI, smoking habit, physical activity and marital status. Information on alcohol consumption was not available. To evaluate the spatial autocorrelation effect on risks we used the Besag-York-Mollié full bayesian models, with expected counts controlled by individual covariates and using a proximity matrix between municipalities. Results 10 μg/m3 increase of PM2.5 mean annual level concentration was associated with HR of 1.05 (95% C.I. 1.03;1.08) for all-cause mortality, of 1.09(1.04;1.13) for all-cancers mortality, and of 1.18(1.08;1.29) for lung caner mortality. Hospital admissions analysis showed HR of 1.02(1.01;1.03) for all natural causes, of 1.04(1.01;1.06) for all cancers, of 1.12(1.04;1.22) for lung cancers, and of 1.03(1.01;1.04) in cardiovascular diseases. Taking into account spatial autocorrelation a slight reduction of risks were seen. Conclusions The results are preliminary since only 2005 PM2.5 data were used for the analysis. Preliminary results are comparable to other European and Northern American cohorts.

Abstract Number	**O-2-10-01**
Presenter	Jiayun Yao*, Michael Brauer, Sarah B. Henderson
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Assessment of the association between predictions from a wildfire smoke forecasting system and respiratory health indicators

Background: Exposure to wildfire smoke has been associated with increases in measures of respiratory health. Forecasts of smoke exposure can provide prospective information to support public health responses. The BlueSky Wildfire Smoke Forecasting System (BlueSky) predicts hourly PM2.5 (particulate matter < 2.5 micron in aerodynamic diameter) concentrations from wildfires for western Canada. Previous evaluation suggests reasonable agreement of BlueSky predictions with PM2.5 measurements and remote sensing data. Assessing the association between BlueSky predictions and health indicators is another important step for evaluating the role of BlueSky in public health decision making. This association has not been investigated in any previous evaluation of forecasting models. Aims: To assess the associations between BlueSky predictions and population-scale indicators of respiratory health during the 2010 fire season in British Columbia, Canada. Methods: The daily counts of prescription asthma reliever dispensations and asthma outpatient physician visits were aggregated for each geographic health unit. Smoke exposures predictions from BlueSky and daily PM2.5 measurements from monitoring stations were assigned to each unit. Poisson regression was used to estimate the association between these exposures and health indicators. Analyses were also stratified by areas with different extents of smoke impact. Results: For an increase of 30µg/m3 in BlueSky forecasted PM2.5, the relative rate (RR) for asthma reliever dispensations was 1.04 (95% CI 1.02 - 1.05), compared with 1.12 (95% CI 1.08 - 1.15) for PM2.5 measurements. Significant effects were observed in areas constantly covered by smoke plumes, but not in less smoke-impacted areas. Smaller but significant effects were estimated for asthma physician visits. Conclusions: BlueSky forecasts were significantly associated with respiratory health indicators. These results support its utilityfor informing public health decision making.

Abstract Number	**O-2-10-02**
Presenter	Matthew J. Bechle*, Dylan B. Millet, Julian D. Marshall
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Monthly national satellite-based land-use regression of NO2 in the United States for 2000 - 2010

Background: Land use regression (LUR) is widely used for estimating within-urban variability in air pollution, typically at the urban level and for long-term averages. LUR techniques have recently been extended to national and continental scales.Aims: Our aim is a LUR for NO2 in the continental US that provides the excellent spatial resolution found in most LURs (~100-m scale), incorporates satellite estimates, covers 100% of US Census Blocks, and provides monthly average concentrations for one decade. Methods: Our work extends a previously-published national LUR for year-2006 in the US. We employ eleven years (2000-2010) of hourly NO2 measurements from US EPA monitors to calculate monthly scaling factors, which account for deviations relative to the reference year. We then create a spatially-varying (inverse-distance weighted) “scaling surface” for each month, to estimate monthly concentration deviations at non-measurement locations.Results: The resulting model captures, on average, 86% of the spatial variability and 72% of the temporal variability with low average bias (26%). Model performance is best at locations near monitors (e.g., spatial R2 = 0.90, mean bias 8% for the tertile with the lowest mean distance to the three nearest monitors). Urban and suburban locations perform moderately better than rural locations at predicting spatial (R2: 0.80 , 0.84, and 0.77, respectively) and temporal (R2: 0.78, 0.76, 0.63) variability and significantly better at predicting absolute concentrations (mean bias: 18%, 10%, 59%). Conclusions: Our approach reliably estimates monthly outdoor NO2 concentration at a spatial resolution capable of capturing within-urban and near-roadway variability in concentrations. We apply this technique to the ~8 million US Census blocks in the contiguous United States to provide a decade (2000 - 2010) of high-resolution monthly NO2 concentration estimates; these data are publicly available.

Abstract Number	**O-2-10-03**
Presenter	Meng Wang*, Rob Beelen, Kees de Hoogh, Bert Brunekreef, Gerard Hoek
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Developing and evaluating land use regression models for NO2 in city-wide, regional, and continental scales in Europe

Background: The applications of land use regression (LUR) models were mainly focused on the intra-urban level. However, developing models based on several areas with geographical similarity and consistency of the input data may explain the distributions of air pollution better due to the inclusion of a larger number of sampling sites. Aim: We aim to explore the feasibility of developing LUR models in larger areas and to compare the model performances systematically in different geographical scales in Europe. Methods: We developed LUR models for NO2 at regional and continental scales based on 23 ESCAPE (European Study of Cohorts for Air Pollution Effects) study areas with pooled data and standard protocols. Models in different spatial scales were evaluated with cross validation (CV) and hold-out validation (HV) and were compared with the performances of the city/country-specific models. In addition, we investigated the prediction abilities of the models in independent areas from where no measurements were used for model building. Results: The overall model performances in terms of the model R2 and CV R2 were highest for models at local scale (model :0.85, CV: 0.79) and lowest for models at continental scale (model: 0.57, CV: 0.55). However, the regional scale models (HV:0.39~0.69) revealed higher predictive power in the independent sites than the local models (HV:0.32~0.59) except for the regional model in south Europe where the local models performed better (HV local: 0.64; region: 0.49). The transferable models explained a reasonable fraction of variability in independent areas (HV region: 0.48; EU: 0.53). Conclusion: It is possible to develop LUR models combining measurements from several study areas which outperform the city/country specific models in terms of the prediction ability to the external validation sites. These models can also be transferred to predict the NO2 concentrations in cities with similar geographical conditions and common predictor variables where no measurement data are available.

Abstract Number	**O-2-10-04**
Presenter	Martina S. Ragettli*, Charlotte Braun-Fahrländer, Ming-Yi Tsai, Audrey de Nazelle, Christian Schindler, Laura Perez, Alex Ineichen, Regina E. Ducret-Stich, Nino Kuenzli, Harish C. Phuleria
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Simulation of NO2 commute exposure – Investigation of its contribution to total exposure and comparison of air pollution models

Background: Little is known about the commute exposure to traffic-related air pollution of a general population and its contribution to total daily exposure. Aims: Our aim is to estimate population based NO2 exposure during commute in Basel, Switzerland, using detailed information on commute behavior and commute route and three air pollution models of varying spatial resolutions. Methods: Firstly, trips between home and work places are simulated by means of a Geographic Information System model using extensive time-activity information from the Swiss 2010 Microcensus database, which provides temporally and spatially resolved data on travel behavior. Secondly, exposure to air pollution is estimated by combining the commute patterns and home and work locations with estimates from air pollution models. Thirdly, the contribution of time-weighted commute exposure to annual NO2 estimates is assessed. Simulating variations of commute patterns (e.g. avoiding main roads) allows us to test scenarios of change in commute behavior on exposure distribution. Finally, three air pollution models (land use regression model, a high and low resolution dispersion model) are evaluated for estimating commute and total NO2 exposures as a marker of traffic-related air pollution in epidemiological exposure assessment studies. Results: The main mode of travel to work in Basel was public transport (52%), followed by car (18%) and bike (17%).Within the Basel area, the average daily time spent in transit between home and work locations was 52 ±37min. Our first results reveal significantly higher average NO2 concentrations during commute (28.2µg/m³, range: 11.6-54.5µg/m³) than at home outdoor locations (25.5µg/m³, range: 11.8-43.4µg/m³). Conclusions: The results will be further examined and contribution of commute to total daily exposure will be quantified. The study will contribute to a better understanding of population commute exposure to NO2 and its relevance in long-term epidemiological exposure assessments.

Abstract Number	**O-2-10-05**
Presenter	Michael Breen*, Janet Burke, Stuart Batterman, Alan Vette, Gary Norris, Christopher Godwin, Matthew Landis, Carry Croghan, Thomas Long, Bradley Schultz, Paul Harbin
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Air Pollution Exposure Model for Individuals (EMI) in Asthma Health Study: Predicting Air Exchange Rates for Residences in Detroit, Michigan

BACKGROUND: The Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS) is investigating the relationship between near-roadway exposures to air pollutants and respiratory responses in asthmatic children living near major roads in Detroit, Michigan. The study uses an integrated measurement and modeling approach to assess the children's exposure to near-road air pollution. To estimate tiers of exposure metrics, we developed an exposure model for individuals (EMI). One tier of EMI is the air exchange rate (AER) for homes, where people spend most of their time. The AER, which is the airflow into and out of a building, is a key determinant for infiltration of outdoor air pollutants. AIMS: Our goal was to calibrate, evaluate, and apply a mechanistic AER model to predict hourly AER for all homes during NEXUS. METHODS: We developed a mechanistic AER model to predict residential AER from building characteristics related to air leakage, indoor-outdoor temperature differences, wind speed, and open windows. Cross validation was used to estimate model parameters and evaluate model uncertainty based on a subset of homes (N=25) with daily questionnaires and daily AER measured on five consecutive days during two seasons (Fall 2010, Spring 2011).The model was then applied to predict hourly AER for all homes (N=150) over the study duration (September 2010 to December 2012). RESULTS: Predicted AER at the individual level matched measured AER with a median absolute difference was 34% (0.18 h-1) and 26% (0.18 h-1) for the fall and spring seasons, respectively. CONCLUSIONS: We demonstrated the feasibility of using a mechanistic model to predict residential AER in a health study. These hourly AER predictions will enable the development of refined tiers of exposure metrics (e.g., residential indoor pollutant concentrations) that account for the diurnal variation of traffic-related pollutants.

Abstract Number	**O-2-10-06**
Presenter	Jeremy Sarnat*, Stefanie Sarnat, W. Dana Flander, Howard Chang, James Mulholland, Lisa Baxter, Vlad Isakov, Halûk Ozkaynak
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Spatiotemporally-Resolved Air Exchange Rate as a Modifier of Acute Air Pollution-Related Morbidity

BACKGROUND: Epidemiological studies frequently use central site concentrations as surrogates of exposure to air pollutants. Variability in air pollutant infiltration due to differential air exchange rates (AERs) has been shown to affect the relationship between central site concentrations and actual exposure, and may thus influence observed health risk estimates. AIMS: We examined AER as an effect modifier of associations between several air pollutant pollutants and emergency department (ED) visits for asthma in a 186 ZIP code area in Atlanta, GA. METHODS: We used a relatively simple AER estimation technique based on accessible data (e.g., Census records, meteorological measurements) to model AER. Epidemiologic analyses of the ED data were conducted using a spatially-resolved Poisson generalized linear models. RESULTS: We found positive associations for the interaction between AER and pollution on asthma ED visits for both CO and NOx indicating significant or near-significant effect modification by AER on the pollutant risk ratio estimates. For these pollutants, ZIP codes with typically higher AERs were generally found to have higher RRs for asthma ED visits. Moreover, assessed temporally across ZIP codes, NOx- and CO-related asthma ED visits were significantly higher on days when AERs were also higher. Distributional tertile analyses showed PM2.5 and AER epidemiological model results to be similar to those found for NOx and CO. Despite the fact that O3 was a strong independent predictor of asthma ED visits, we found no O3-AER effect modification. CONCLUSIONS: To our knowledge, our findings for CO, NOx, and PM2.5, are the first to provide an indication of short-term (i.e., daily) effect modification of multiple air pollution-related risk associations with daily changes in AER.While limited to one outcome category in a single large urban locale, the findings suggest that the use of relatively simple and easy-to-derive AER surrogates may reflect intraurban heterogeneity in short-term exposures to pollutants of ambient origin.

Abstract Number	**O-2-14-01**
Presenter	Gurusamy Thangavel*, Santu Ghosh, Sambandam Sankar, Krishnendu Mukhopadhyay, Vidhya Venugopal, Venkatesan Dasu, Kalpana Balakrishnan, Nigel Bruce, Kirk R. Smith
Exposure	household air pollution
Health domains	other
Type of research	review

Household air pollution and exposures: a systematic review of literature for the revised global household air pollution database

Background: Well over a hundred studies over the last three decades have assessed levels of household air pollution (HAP) in developing countries. In view of this progress we updated the earlier version of WHO global IAP database through a systematic review of studies reported in peer-reviewed literature through 2011. Aim: This exercise was performed to generate pooled estimates of exposures for particulate matter and CO with solid fuel stoves (traditional, improved) and cleaner fuels, and inform the WHO HAP-IAQG (Indoor Air quality Guidelines) process. Methods: We initiated a search for articles indexed in PubMed, Web of Science and Bioscience databases with keywords and MeSH terms using PRISMA guidelines. A total of 161 articles were selected from over 6800 citations. 46 PM studies and 27 CO studies were included for generating pooled estimates for 24 h concentrations and/or exposures. Results: The pooled mean and pooled S.D. for 24 hr kitchen area concentrations of PM2.5 in solid fuel using households are estimated to be 972 µg/m3(S.D. 876 µg/m3) as compared to 148µg/m3 (S.D. 56 µg/m3), in households using gas, electricity or kerosene as primary fuels. The corresponding 24 hr personal exposures in solid fuel using households are estimated to be 267µg/m3 (S.D. 297 µg/m3) and 219µg/m3 for women and children respectively, with exposures in gas/electricity using households being comparable to the kitchen area concentrations. The pooled mean and pooled S.D for 24 hr kitchen CO concentrations amongst solid fuel users are estimated to be 8.60 ppm (S.D.6.21ppm) while personal exposures are estimated to be 3.63 ppm and 2.69 ppm for women and children respectively. Estimates of concentrations and exposures for multiple PM fractions and CO across multiple fuel, stove and household configurations have also been generated. Conclusions: The revised WHO-Global database provides a useful platform for comparative analyses of data from multiple studies using periodically updated information.

Abstract Number	**O-2-14-02**
Presenter	Krishnendu Mukhopadhyay*, Rengaraj Ramasamy, Sathish Madhav, Natesan Durairaj, Manickam Natarajan Amudha, Gayathri Rajendran, Arulselvan Sadasivam, Naveen Puttaswamy, Sankar Sambandam, Santu Ghosh, Kalpana Balakrishnan
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	cohort study

Measurement of household concentrations for estimating PM2.5 exposures in pregnant women: Preliminary results from the SICAPHE study

Background: Only a few efforts have been undertaken to assess PM exposures in pregnant women, especially in developing countries. We report preliminary results from PM2.5 measurement exercises in the newly established South Indian Cohort for Air Pollution and Health Effects (SICAPHE) study aimed at generating exposure-response relationships for air pollution and select birth/early childhood outcomes. Aim: To conduct repeated measurements of area concentrations in multiple household micro-environments with time-activity records for estimating daily average PM2.5 exposures in a pregnant mother cohort in South India. Methods: We measured 24 h PM2.5 area concentrations in a rural-urban cohort of pregnant women enrolled in the SICAPHE study (n=724 out of total recruitment target of 1200) and collected detailed time-activity information. 2- 4 repeat measurements were performed in each household covering kitchen, living and outdoor areas using gravimetric low volume samplers. Results: The highest 24h PM2.5 concentrations were recorded in the kitchens (380, 91.8 and 75.8 mg/m3, in biomass, kerosene and LPG using households respectively) with much lower concentrations in the living and outdoor areas. Kitchen PM2.5 concentrations were significantly (p=0.014) higher in rural households as compared to urban households and higher in urban households located in commercial areas as compared to residential areas. Kitchen PM 2.5 concentrations measured in rural (n=399) and urban (n=209) households across the three trimesters were not significantly different from each other (p=0.827 and p=0.284). The time-activity data (n=724) found the profiles to be similar for both urban and rural women with activities in the kitchen and living areas accounting for 20 and 75% respectively during their daily routines. Conclusions: The measurements represent one of the most extensive datasets for estimating PM 2.5 exposures in pregnant women in India. Efforts are underway to perform exposure reconstructions and build exposure models as a function of multiple household level determinants.

Abstract Number	**O-2-14-03**
Presenter	Hyeong-Moo Shin*, Thomas E. McKone, Marcia Nishioka, M. Danielle Fallin, Lisa Croen, Irva Hertz-Picciotto, Craig Newschaffer, Deborah Bennett
Exposure	no exposure
Health domains	no health domain
Type of research	exposure modeling

Tracking Source Strength of Semivolatile Organic Compounds from Indoor Dust

Background/Aims: Consumer products and building materials have been reported as primary sources of a number of semivolatile organic compounds (SVOCs) found in indoor environments. The objectives of this study are to measure household dust concentrations of SVOCs released from consumer products and building materials and estimate SVOC emission rates as a function of chemical properties and dust concentrations by using a fugacity-based indoor mass-balance model. Methods: In this study, we analyzed 30 household dust samples in the U.S. to determine concentrations of six phthalates, four personal care product ingredients, and six flame retardants primarily released from consumer products and indoor surfaces. We then derived generalized analytical solutions from an indoor fugacity model to estimate SVOC emission rates that account for the measured dust concentrations. Emission rates inferred from product use behaviors and diffusive transfers were also estimated and compared to those from the fugacity model. We used these results to evaluate the feasibility of using dust measurements in combination with mass-balance models to infer SVOC emissions. Results: Di-2-ethylhexyl phthalate (DEHP) and di-iso-nonyl phthalate (DINP) were the most abundant compounds in these dust samples. Although dust concentrations vary over two orders of magnitude for phthalates, predicted emission rates from the fugacity model and measured dust concentrations (1.6 – 5.5 mg/d) are comparable to those from product use behaviors and diffusive transfers (0.2 – 13.3 mg/d), indicating that dust measurements can be potential indicators of source strength under the limited information of product use behaviors and chemical concentrations in consumer products and building materials. Conclusion:The combined dust-assay modeling approach shows promise for estimating indoor emission rates for SVOCs

Abstract Number	**O-2-14-04**
Presenter	Li Liu*, Peter V. Nielsen, Charlotte Damsgaard, Rasmus L. Jensen
Exposure	household air pollution
Health domains	infectious diseases
Type of research	exposure modeling

Numerical Simulations of Interpersol Aerosol Transport in a Single-Aisle Aircraft Cabin

Traditionally, air is supplied to an aircraft cabin either by individual nozzles or by supply slots. Air is expected to be fully mixed in the cabin, and the system is considered to be a mixing ventilation system. This study aims to investigate the transport characteristics of human expiratory aerosols among passengers, when the aircraft cabin is ventilated under different air distribution concepts. Four breathing thermal manikins, simulating four passengers, are located in a full-scale left side section of a single-aisle (Boeing 737) cabin with four seats. When one manikin functions as an index patient, the other three manikin's exposure are profiled when the aircraft cabin is ventilated under displacement ventilation concept, mixing ventilation concept, downward ventilation concept combining with personalized ventilation. The CFD model is validated in cases when aerosols from index patient exhalation are traced by tracer gas N2O. Preliminary results that base on tracer gas reveal that displacement ventilation and downward ventilation concept both result in lower exposure compared to mixing ventilation. Personalized ventilation in all passenger seats does not reduce exposure at flow rates up to 4 L/s per person. Numerical simulations using NaCl solution droplets with internal suspended particles are undergoing. Droplets will shrink to a smaller size due to evaporation. Dispersion of droplet and droplet nuclei will be profiled and compared between scenarios with different ventilation concepts. Recommendations will be addressed for design of the air distribution system in such an aircraft cabin.

Abstract Number	**O-2-14-05**
Presenter	Jelle Laverge*, Michal Spilak, Atila Novoselac, Arnold Janssens, Richard Corsi
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Experimental assessment of the geometrical extend of the inhalation zone of standing, sitting and sleeping persons.

background: In exposure studies and risk assessments, the intake of a pollutant through inhalation is often estimated using the well mixed concentration in the room. More advanced ventilation systems such as stratum ventilation, displacement ventilation or personal ventilation systems aim at higher ventilation efficiencies by creating flow conditions that divert from the well mixed condition. In these cases, as well as in the assessment of exposure to pollutants with near field sources such as text markers, glue, detergents etc. the validity of the use of the well mixed concentration will be limited. To improve understanding of intake in such conditions, the fate of pollutants near the breathing zone needs to be studied closer. aims: The aim of this paper is to determine the geometrical extend of the inhalation zone of standing, sitting and sleeping persons by determining the inhaled fraction of a near field source of a gaseous pollutant and to determine a geometrical zone around the nose where the full mass of the emitted pollutant is inhaled. methods: In this paper, we present the results of experiments with a breathing thermal manikin in an environmental chamber using SF6 as a tracer for gaseous pollutants. results: The thermal plume that is generated by the metabolic heat output has a large impact on the shape of the inhalation zone, limiting exposure to near field sources to those situated almost directly under the nose and next to the torso. For the sleeping manikin, the breathing zone is stretched down along the cheeks due to this same effect. The transient effect of the breathing cycle has only a minor influence on the inhalation zone. conclusions: Based on these results, we conclude that the inhalation of near field sources is dramatically underestimated by the use of the well mixed concentration, especially for sources located on the upper torso, neck and chin of the exposed person.

Abstract Number	**O-2-14-06**
Presenter	Nai-Yun Hsu, Yu-Qi He*, Huey-Jen Su
Exposure	household air pollution
Health domains	no health domain
Type of research	time series study

Influence of Climate Variation on Indoor Air Quality: a 15-year Profile Analysis of Indoor Fungal Pollutants

Buildings are major and only shelters for human to refrain from direct impacts of climate change and rising frequency of disasters. The importance of indoor environment quality is therefore more critical while the time people spent indoors is ever more increasing. Furthermore, higher ambient temperature and more extreme weather events are suggested to result in worsen indoor air quality, as a consequence from in-outdoor interaction. Yet, the physical and chemical impact of climate change on indoor environment remains relatively unclear. The aim of this study is to evaluate the effects of potential climatic or weather variations on indoor air pollutants (IAP), using a 15-year monitoring data collected from 802 different buildings span throughout the island of Taiwan. The profile of total culturable fungal concentration, reported to be attributable to various adverse health effects, would be taken as an example for preliminary analysis. Since 1998, our team has continuously collected IAP data from 322 home, 162 school, 106 offices and 212 public places of diverse functions, following the standard procedure of indoor investigation. A total of 1757 indoor and 1749 outdoor total culturable fungal levels are included in the analysis, with averages (sd) of 4543.1 (9518.6) CFU/m3 and 5502.4 (11013.3) CFU/m3, respectively. Highest average levels of fungi and its in-outdoor (I/O) ratio are found in the building type of school, or during the winter season (December to February). Higher temperature of 8-hour daytime average, no matter indoors (crude OR=1.17, 95%CI 1.13-1.21), outdoors (cOR=1.08, 95%CI 1.05-1.10) or atmospheric (cOR=1.06, 95%CI 1.04-1.09), is one of the major determinant for the increasing fungal I/O ratio. Moreover, fungal I/O ratio also increased with the year of investigation (adjusted OR=1.11, 95%CI 1.07-1.15) after adjusting for ambient temperature, geographical location, sampling season and type of building. This study is the first to evidence the impact of climate variation on IAPs by using a 15-years dataset.

Abstract Number	**O-2-15-01**
Presenter	Huan Shu*, Ryan W. Allen, Carl-Gustaf Bornehag, Michael Brauer, Jeffrey Brook, Bruce Lanphear, Sheela Sathyanarayana, Malcolm R. Sears, Leilei Zeng, Tim K. Takaro, CHILD Environmental Working Group
Exposure	biomarker
Health domains	respiratory disease
Type of research	cohort study

Phthalate Exposures in a Canadian Birth Cohort at Three Months of Age: the CHILD Study

Background Exposure to phthalates has been associated with the development of wheeze and asthma. While infants may be exposed via multiple routes, the sources of infant exposure aren't fully understood. Aims To identify and quantify sources of phthalate exposure in infants. Methods We employed the Canadian Healthy Infant Longitudinal Development (CHILD) Study, a multicentre, longitudinal, population-based birth cohort with 3,300 children to identify sources of phthalate exposures in infants. For the first 1,539 CHILD participants we examined associations between 6 urinary phthalate metabolites, measured at 3 months of age and corrected for specific gravity, with 90 variables characterizing the indoor environment, including furnishings, household care products and personal care products. Univariate, Bivariate, and Tobit regression were used for modeling. We also examined the relationship of urinary phthalates with socio-demographic characteristics and breastfeeding. Results Overall, there were 32 variables associated with higher concentrations and 20 inverse associations. We found higher urinary phthalates among children whose families used oven cleaners (MBP (β=7%, 95%CI: 2-15%), MBzP(β=15%, 5-26%), and MEP(15%, 5-26%)) and air fresheners (MBP (4%, 2-10%), MBzP(10%, 5-15%), and MEP(10%, 5-17%)), or who heated food in hard plastic (MBP (32%, 15-48%), MEHHP (29%, 7-51%). Soft vinyl flooring was highly correlated with MBzP (58%, 35-91%). MEHP, MEHHP, and MEOHP concentrations were lower in children who were breastfed. Household income was inversely associated with MEOHP concentrations. Conclusions Our analysis demonstrated higher levels of phthalate metabolites associated with use of household product and plastics. The identification of these exposures as possible contributors to phthalate body burden in three-month-old children is an important step in exposure categorization and supports efforts to reduce exposure.

Abstract Number	**O-2-15-02**
Presenter	Hsin-Wen Chang*, Nai-Yun Hsu, Jiu-Yao Wang, Huey-Jen Su
Exposure	biomarker
Health domains	allergies
Type of research	cross-sectional study

Phthalates exposure and the profiles of allergic and inflammatory cytokines in Taiwan's children

Background:Phthalates (PAEs) exposure is shown in epidemiology studies for association with reporting respiratory symptoms and allergic diseases in children. However, the mechanisms of allergic or inflammatory response have not been comprehensively evaluated from field study in real environment. Aims:We investigated the underlying mechanism to PAEs exposure, using urinary metabolites levels and the allergic and inflammatory cytokines in children. Methods: A total of 101 pre-school children selected from previous questionnaires surveys were invited to clinics for allergic symptom diagnosis and serum sample collection. PAEs exposure was characterized by standardized questionnaire interview, and house dust and urine samples were collected during households' visits. Metabolites of PAEs (MMP, MBP, MEP, MBzP, MEHP, MEHHP and MEOHP) in urine were analyzed by GC/MS, and cytokines (IL-4, 5, 6, 8, 12, 13, IFN-γ and TNF-α) in serum were measured by flow cytometry. Results: Lower levels of PAEs in urine were related to higher level of IL-4 in serum. When further dividing study children by PAEs' metabolites levels and allergic symptoms scores by doctor's diagnosis, we found that children in higher MEP and MEHP group with higher symptoms scores reported higher IL-8 level in serum (MEP: 2.41 v.s. 1.89 pg/ml, p=0.01; MEHP: 2.31 v.s. 1.88 pg/ml, p=0.03). Conclusions: The levels of inflammatory cytokine, such as IL-8, had a significant positive trend with PAEs'metabolites (MEP, MEHP) levels whereas the levels of allergic cytokine, IL-4, had a negative correlation. We therefore propose that PAEs exposure may more likely to be linked to the immune response of inflammation.

Abstract Number	**O-2-15-03**
Presenter	Jérémie Botton*, Claire Philippat, Antonia M. Calafat, Manori Silva, Marie-Aline Charles, Rémy Slama
Exposure	biomarker
Health domains	obesity
Type of research	cohort study

Prenatal exposures to phthalates and postnatal growth in boys during the three first years of life

Background: A recent study reported a relationship between urinary concentrations of monoethyl phthalate (MEP) and body size in a New York City population of overweight children. Aims: To study the association between maternal pregnancy exposure to phthalates and male offspring's postnatal growth in a prospective setting. Methods: In a subsample of 520 pregnant women from EDEN mother-child cohort who gave birth to a boy, we measured 11 phthalate metabolites in one spot maternal urine samples collected at 22-29 weeks of gestation. Using weight and height measured during the clinical exams or collected from health booklet (respectively, median=17 and 15 measures / child), we modeled individual growth trajectories from birth to 3 years and calculated weight and height growth velocities. The associations between metabolite concentrations and growth parameters were studied using adjusted linear models and reported for one inter-quartile range (IQR) increase in exposure biomarkers. Results: Concentrations of phthalate metabolites were not significantly associated with birthweight. An IQR increase in MEP and in monobenzyl phthalate (MBzP) were associated with increased weight at 30 months (respectively β=127g, p=0.07 and β=149 g, p=0.02). The associations emerged earlier for MBzP which was positively associated with weight growth velocity (WGV) at 3 months (β=16.1g/mo, p=0.002) than for MEP (strongest association with WGV at 2 years: β=5.8g/mo, p=0.007). We also found an inverse-U shape association between high-molecular weight phthalates and weight at 30 months. There was no significant association with height growth parameters. Discussion: We highlighted associations between exposure to butylbenzyl (metabolite=MBzP) and diethyl (metabolite=MEP) phthalates during pregnancy and postnatal body size in boys, with different timing of occurence. Results need to be replicated in other mother-child cohort studies with repeated exposure assessment.

Abstract Number	**O-2-15-04**
Presenter	Martine Vrijheid*, Maribel Casas, David Martínez, Damaskini Valvi, Ana Ballesteros-Gómez, Noelia Luque, Soledad Rubio, Jordi Julvez, Jordi Sunyer
Exposure	biomarker
Health domains	neurodevelopment
Type of research	cohort study

Prenatal Bisphenol A Exposure and Cognitive and Behavioural Development in Children

Background: Experimental evidence suggests that bisphenol A (BPA) may be a neurodevelopmental toxicant. Several small epidemiological studies concluded that prenatal BPA exposure may affect child behavioural development in a sex-specific manner, but findings are not consistent. Aims: To examine the effects of prenatal BPA exposure on cognitive and behavioural development in children at age 14 months and 4 years from the Spanish INMA birth cohort. Methods: BPA concentrations were measured in two maternal spot urine samples collected in trimester 1 and 3 of pregnancy; the average of the two creatinine-adjusted BPA concentrations was used as exposure variable. Cognitive and psychomotor development were assessed at 14 months with the Bayley Scales of Infant Development and at 4 years with the McCarthy Scales of Children's Abilities. At 4 years, attention deficit hyperactivity disorder (ADHD) symptoms were assessed with the DSM-IV scales and autism symptoms with the Childhood Autism Spectrum Test. Analyses used linear, logistic and negative binomial regression models and included 349 mother-child pairs. Results: BPA concentrations were 2.6 µg/g creatinine in 1stand 2.0 µg/g in 3rd trimestersamples (correlation=0.14, p<0.01). BPA exposure was associated with an increased risk of ADHD-hyperactivity symptoms (IRR per log10µg/g creatinine=2.71; 95%CI 1.39-5.26) and a reduction in psychomotor development (b=-4.28; -8.25, -0.32); these associations were strongest in boys. In girls, BPA was related to an increased risk of autism symptoms (OR=13.1; 1.03, 166), based on only 11 girls with symptoms. BPA exposure was not associated with the mental development score at age 14 months, or with the McCarthy general cognition score or its sub-scores at 4 years. Conclusion: Prenatal BPA exposure may affect children's behavioural development, but does not appear to affect cognitive development. Uncertainties in BPA exposure estimation may have biased results towards the null hypothesis.

Abstract Number	**O-2-15-05**
Presenter	Just Allan*, Joseph Braun, Dana Boyd Barr, Katherine Svensson, Lourdes Schnaas, Alejandra Cantoral Preciado, Martha Maria Tellez-Rojo Solis, Andrea A Baccarelli, Robert O. Wright
Exposure	biomarker
Health domains	obesity
Type of research	cohort study

A pilot study of prenatal urinary bisphenol A concentrations and longitudinal measures of child growth through two years in a prospective Mexico City cohort.

Background: Bisphenol A (BPA) is a widely used potential endocrine disruptor. In some animal studies, prenatal exposure to BPA is associated with higher postweaning weight. Cross-sectional studies show both adult and children's concurrent exposure is associated with obesity but prospective studies, particularly those with prenatal exposure data are needed. Aims: To examine the association between maternal urinary BPA concentrations and children's body mass index (BMI) prospectively in a Mexico City pregnancy cohort. Methods: Pregnant women gave spot urine samples in the 2nd trimester and their children had anthropometry at up to 6 visits between birth and 24 months. Children's BMI z-scores were calculated using WHO norms. In a subsample (n=84), total urinary BPA concentration was measured with gas chromatography – mass spectrometry after derivatization. Mixed effects regression models estimated the association between prenatal BPA concentrations (natural log transformed) and child's BMI z-score at 323 study visits, adjusting for specific gravity, sex, a spline for child age, and maternal reported pre-pregnancy BMI. Results: Prenatal BPA concentrations were similar to those in US pregnant women (geometric mean 2.7 ng/ml; interquartile range (IQR) 1.3 to 7.2 ng/ml; 92% > reporting limit of 0.4 ng/ml). There was a suggestive positive association between prenatal urinary BPA concentrations and child BMI. An interquartile range difference in log BPA concentrations was associated with a 0.17 unit increase in BMI z score (95% CI -0.02 to 0.42). Exploratory analysis suggested that this association might be larger at the later ages but awaits further follow-up data. Conclusions: In this pilot study, prenatal urinary BPA, a candidate obesogen, had a suggestive positive association with children's BMI. Ongoing analyses will include a second prenatal urinary exposure measure, an expanded sample size, growth measures at later ages, and detailed obesity phenotypes.

Abstract Number	**O-2-15-06**
Presenter	Chia-Jui Chuang, Pen Hua Su, Hsiao-Yen Chen, Chien-Wen Sun, Shu-Li Wang*
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

Effects of Phthalate Exposure on Thyroid Function in 2, 5, 8, and 11 Year-Old Children from Central Taiwan

Background: Phthalates are used extensively in many medical and convenience products, resulting in widespread people exposure through multiple ways. In view of some studies suppose that exposure to phthalates will be associated with altered thyroid function in mice. We aim to provide estimates of the effect of phthalate exposure on thyroid function from longitudinally follow-up children. Methods: We studied 2-year-old (n=88), 5-year-old (n=111), 8-year-old (n=167), and 11-year-old (n=155) children from central Taiwan. The serum level of thyroxine (T4), triiodothyronine (T3), unbound T4 (FT4), thyroxine-binding globulin (TBG), and thyroid-stimulating hormone (TSH) were measured by radioimmunoassay. In the meanwhile, we assessed seven phthalate metabolites (MMP, MEP, MnBP, MBzP, MEHP, 5OHMEHP, and 5oxoMEHP) in urine samples of children by LC-MS/MS. Results: We provided the multiple regression to estimate the levels of T3, T4, T3/TBG ratio, T4/TBG ratio, and log(FT4xTSH) against phthalate metabolites after adjusting for sex, age, and BMI. We found that the FT4 level was declined by 5oxoMEHP (ß=-0.08,p=0.01) in 2-year-old children. Moreover, the concentration of MMP (ß=-0.37,p=0.02) and 5OHMEHP (ß=-0.29,p=0.04) had significantly reduced the T4 level in 8-year-old children. We also found that the MnBP (ß=-2.81,p=0.01) and MBzP (ß=-0.19,p<0.01) had significantly and negatively related to the T3 and T4 level through the age by the generalized estimating equation method, respectively. Conclusions: In conclusion, urinary phthalate metabolites are associated with altered thyroid hormones in children. Further studies of teenager are needed to trace the observed findings. Keywords: Phthalates; Thyroid hormone; Longitudinal dataset

Abstract Number	**O-2-16-01**
Presenter	I-Jen Wang*, Pau-Chung Chen
Exposure	organic compounds
Health domains	allergies
Type of research	cohort study

The effect of phthalate acid esters exposures on later allergic diseases

Background: During the same period of time that the use of endocrine disrupting chemicals has increased, there has been a remarkable increase asthma and allergy in children. However, the role of phthalate exposure in the immune system is not well-known. Most of the previous studies were cross sectional design without a causal link. Aims: To conduct a birth cohort study to address the effect of early life phthalates exposure onthe development of atopic dermatitis (AD) and the IgE-sensitization by objective biomarkers. Methods: Urine specimens were collected fromTaiwan Birth Panel cohort study with 483 mother/infant pairs. Monoethyl phthalate (MEP), mono-n-butyl phthalate (MBP), mono-iso-butyl phthalate, monobenzyl phthalate (MBzP), and mono-(2-ethylhexyl) phthalate (MEHP) at 3rd trimester of pregnancy and at ages 2 and 5 were measured by ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). At ages 2 and 5, information on the development of AD and serum total IgE were collected. The association between urine phthalatemetabolites levels at different stages and serum IgE and AD were evaluated. Results: Urine phthalate metabolites levels were higher at age 2 than those at pregnancy and age 5. At each period, urine MBP levels were higher than MEP, MEHP, and MBzP. MEHPlevels at age 2 positively correlated with serum IgE levels (per ln-unit: β=0.191 ng/ml, p=0.027). Analyses stratified by gender revealed that MEHP levels positively correlated with serum IgE levels only in boys (per ln-unit: β=0.256 ng/ml, p=0.034). When dividing into quartiles in the fully adjusted models, urine MBzP at ages 2 had a significant association with AD. We found no statistically significant association of other phthalate metabolites with IgE and AD. Conclusions: Early postnatal phthalate exposure plays an important role in the development of allergic sensitization and atopic disorders in addition to prenatal exposure.

Abstract Number	**O-2-16-02**
Presenter	Pierre Lajoie*, Véronique Gingras, Francine M. Ducharme, Patrick Daigneault, Daniel Aubin, Denis Gauvin, Jean-Marc Leclerc, Marilène Courteau, Suzanne Gingras, Don Fugler, Hans Schleibinger
Exposure	household air pollution
Health domains	respiratory disease
Type of research	randomized trial

IVAIRE - A Randomized Controlled Study on the Impact of Ventilation on IAQ and Respiratory Symptoms of Asthmatic Children in Single Family Homes: Health aspects

Background and aims Important knowledge gaps remain concerning health effects of ventilation.We measured the impact of increased ventilation rates on concentrations of indoor air contaminants and on the frequency of asthma symptoms. Results on environmental and health aspects are presented in two separate abstracts. Methods A randomized controlled study was conducted with 83 asthmatic children (ages 3 to 12) living in homes with a ventilation rate < 0,3 h-1. During years 1 (pre-intervention) and 2 (post-intervention), asthma symptoms were measured via a daily diary and ISAAC questionnaire. Children were randomized after year 1 (43 I; 40 C) and the ventilation rate was increased in the homes of the intervention group by optimization or new installation. The primary health outcome was the mean number of days with symptoms per 14 days during the heating season. The proportion of children with wheezing was also compared. Mixed linear models with repeated measures were used to assess the difference in outcome between the intervention and control groups, and the impact of the reduction of contaminants on symptoms in the intervention group. Results From year 1 to year 2, the mean number of days with symptoms decreased from 6,4±0,8 to 5,0±0,8 in the intervention group and from 5,4±0,8 to 4,5±0,8 in the control group (p=0,58). The proportion of children with wheezing episodes decreased from 77,4%±0,10 to 42,5%±0,10 in the intervention group compared to 83,6%±0,10 to 70,8%±0,10 in the control group (p=0,03). Estimated decrease of the prevalence of wheezing related to a 50% reduction of formaldehyde concentration was 6,2% ±0,03 (p=0,04). Conclusions Increased ventilation rate had no significant impact on the frequency of asthma symptoms during the heating season. However, it was associated with a significant decrease of the prevalence of wheezing in the intervention group on a whole year basis. Reduction of formaldehyde concentrations may explain the decrease of wheezing.

Abstract Number	**O-2-16-03**
Presenter	Olena Gruzieva*, Ulrike Gehring, Raymond Agius, Elaine Fuertes, Joachim Heinrich, Claudia Klümper, Ursula Krämer, Anna Mölter, Bert Brunekreef, Göran Pershagen
Exposure	ambient air pollution
Health domains	allergies
Type of research	meta-analysis

Air pollution exposure and allergic sensitization in children: a meta-analysis of five European birth cohorts within the ESCAPE project

Background: The evidence on long-term effects of air pollution exposure on childhood allergy is limited. Objective: We investigated the association between air pollution exposure and allergic sensitization to common allergens in children followed prospectively during the first 10 years of life. Methods: Five European birth cohorts participating in the ESCAPE project were included: BAMSE (Sweden), LISAplus and GINIplus (Germany), MAAS (Great Britain) and PIAMA (The Netherlands). Land-use regression models were applied to assess the individual residential outdoor levels of particulate matter with aerodynamic diameter <2.5 µm (PM2.5), 2.5-10 µm (PMcoarse), and <10 µm (PM10); PM2.5 absorbance, nitrogen dioxide, and nitrogen oxides (NOx). Blood samples drawn at 4-6 and/or 8-10 years from more than 6500 children were analyzed for allergen-specific serum IgE against common allergens. Associations were assessed by multiple logistic regression, and subsequent meta-analysis. Results: Overall, air pollution exposure was not associated with sensitization to any common allergen, with odds ratios ranging from 0.94 (95% CI, 0.63–1.40) for 1×10-5 m-1 increase in PM2.5 absorbance to 1.26 (0.90-1.77) for 5 µg/m3 increase in PM2.5 exposure at birth address. However, subgroup analyses suggested a higher risk of sensitization in relation to air pollution exposure among boys (OR for PM2.5 exposure at birth address: 1.62 (95% CI, 1.05-2.50)) and in children who did not change address since birth (1.68, 95% CI, 1.03–2.75) for exposure to PM2.5 absorbance. Conclusion: No clear associations between air pollution exposure and development of allergic sensitization in children up to 10 years of age were revealed.

Abstract Number	**O-2-16-04**
Presenter	Sungroul Kim*, Yongbae Kim, Ara Jung, Choon-sik Park
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-crossover study

Winter Season Temperature Drops and Sulfur Dioxide Levels Affect on Exacerbation of Refractory Asthma in South Korea

Background. According to the American Thoracic Society, approximately 5% of all asthmatics have refractory asthma (RA); these patients fail to recover lost lung function even after long-term treatment with high doses of medications. Aims: We assessed the prevalence of RA and evaluated the association between acute exposure to ambient air pollution and meteorological conditions with acute exacerbation of RA after controlling for smoking and seasonality. Methods. Using a time-trend controlled case-crossover study design, we calculated odds ratios to evaluate whether exposure to ambient air pollutants and certain meteorological conditions on the day of admission (Lag 0) and up to 3 days before admission (Lag1 through Lag 3) were associated with acute RA exacerbation. Results were obtained after controlling for the effects of seasonality, smoking, and allergen sensitivity; we stratified our data into four seasons with respect to the median temperature of each month and further stratified them according to self-reported smoking status and skin-prick test results. Results. In our study, RA patients (n = 82), living in metropolitan city of Seoul and Kyunggi Province, accounted for 3.7% of all asthmatics (n=2298) registered in our asthma cohort between 2005 and 2009. In winter, a 1_C decrease in ambient temperature and a 1 ppb increase in sulfur dioxide concentration on the day of Lag 1 were associated with 14.8% (95% confidence interval [CI]: 0.9–26.7) and 19.7% (95% CI: 3.3–38.7) increases in the risk of RA exacerbation among nonsmokers, respectively. Similar associations were obtained on the day of Lag 2. The association remained unchanged after excluding patients sensitive to Dermatophagoides farinae and Dermatophagoides pteronyssinus. Conclusions. Exposure to temperature drops and increased sulfur dioxide concentrations are positively associated with the occurrence of acute RA exacerbation during winter with 1 or 2 day lags.

Abstract Number	**O-2-16-05**
Presenter	Stuart Batterman*, Liuliu Du, Edith Parker, Thomas Robins, Toby Lewis, Bhramar Mukherjee, Erminia (Minnie) Ramirez, Zachary Rowe, Wilma Brakefield-Caldwell
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Participant Use of Free-Standing Filters in an Asthma Intervention Study

Background. Freestanding air filters can easily and effectively reduce indoor concentrations of particulate matter (PM), and filters have been recommended to reduce exposures and improve respiratory health. However, epidemiological studies examining air filters have had inconsistent results, which may be attributable to small sample sizes, lack of measurements verifying filter effectiveness, unmeasured and uncontrolled covariates, and uncertainty whether filters were used as intended. Objectives. This study characterizes the use of HEPA air filters among 89 households participating in an intervention study examining the respiratory health of children with asthma. We evaluate weekly and diurnal use patterns, family and household characteristics that might encourage or present barriers to filter use, and the significance of findings in terms of the possible exposure misclassification. This information is relevant to interpreting intervention studies and informing actions aimed at improving indoor air quality (IAQ) and respiratory health. Methods. Freestanding air filters were placed in the child's bedrooms, and caregivers were instructed to use the filter continuously. Filter use was monitored continuously for approximately a year in households, and IAQ was monitored seasonally over one-week periods. Results. Filter use dramatically lowered PM concentrations. Use was initially very high, averaging 87±24%, but dropped to only 38±40% after 3 weeks. Filter use rebounded to 67±31% when families were visited for health assessments. Use was slightly higher at night and in households where tobacco smoking was detected. Few family or household factors were consistently identified with filter use patterns. Conclusions. While effective, filters must be considered an active intervention requiring evaluation and monitoring, otherwise, unknown and unexpected use patterns may cause substantial exposure misclassification and bias results of intervention studies.

Abstract Number	**O-2-16-06**
Presenter	Laura Corlin*, Mark Woodin, Tina Wang, Ami Chi, Doug Brugge
Exposure	others
Health domains	autoimmune disease
Type of research	cross-sectional study

COMPARING FACTORS ASSOCIATED WITH ASTHMA BETWEEN CHINESE IMMIGRANT AND WHITE NON-IMMIGRANT ADULTS

Background: Little is known about why first generation immigrants tend to have lower asthma prevalence. Aims: The aim was to examine factors putatively associated with asthma in adult Chinese immigrants. Methods: Patient questionnaire and clinic data on diagnosed asthma, environmental exposures, and personal factors from the Community Assessment of Freeway Exposure and Health Study (CAFEH), a cross-sectional community based participatory study, were used. Inclusion criteria were: first generation Chinese immigrant or white native born American, >40 years of age, and residence in one of three study areas. Results: Asthma prevalence among adult Chinese immigrants (4.2%) was significantly less than for U.S. born white adults (17.8%; c2=19.0, p<0.0005). Statistically significant associations with asthma were found in the combined Chinese and white sample for: education (c2=462.00, p<0.0005), co-morbidities (c2=17.58, p<0.0005), and a trend for log mean inflammation levels measured by TNFα-RII (t=-1.8, p=0.07). Statistically significant differences were found between Chinese and white participants for: education (c2=468.7, p<0.0005), income (c2=18.0, p<0.0005), occupational exposure to chemicals, dust, or asbestos (c2=13.9, p<0.0005), residence within 100m of highways (c2=31.8, p<0.0005; c2=34.2, p<0.0005), log mean TNFα-RII levels (t=-5.0, p<0.0005), and a trend for mean log CRP levels (t=1.9, p=0.06). Conclusions: Chinese immigrants had lower asthma prevalence than whites despite their lower SES. This may be partially explained by less occupational exposure and possible environmental differences leading to less inflammation. Status as first generation immigrants may be protective, although data about these individuals' early life experiences were not available.

Abstract Number	**O-2-17-01**
Presenter	Kayoko Kato, Lee-Yang Wong, Carmen Dunbar, Tao Jia, Aimin Chen, Glenys Webster, Bruce Lanphear, Antonia M. Calafat*
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Maternal and fetal exposure to polyfluoroalkyl chemicals during gestation

Background. Polyfluoroalkyl chemical (PFC) surfactants can cross the placenta. However, data on the maternal PFCs concentrations during gestation and transfer of PFCs to the fetus are limited. Aims. To correlate PFCs concentrations in paired maternal–cord sera and determine potential changes in PFCs concentrations during gestation. Methods. In a multiethnic cohort of pregnant women recruited in 2003-2006 from Cincinnati, Ohio, USA, we measured four PFCs in maternal serum at approximately 16 weeks of gestation, in umbilical cord serum, and in paired maternal and cord sera collected at delivery by on-line solid phase extraction–high performance liquid chromatography–isotope dilution tandem mass spectrometry. Results. We detected perfluorohexane sulfonate (PFHxS), perfluorooctane sulfonate (PFOS), perfluorooctanoate (PFOA) and perfluorononanoate (PFNA) in >90% of the samples analyzed. PFHxS, PFOS, PFOA and PFNA concentrations in mothers' sera at 16 weeks of gestation and in their infants at delivery were highly correlated (Pearson correlation coefficient [r] =0.74-0.94). Similarly, mothers' PFCs serum concentrations at 16 weeks and at delivery were highly related (r=0.82-0.95). In 71 maternal-infant dyads, the least square geometric mean concentrations (95% confidence interval) of PFHxS, PFOS, PFOA, and PFNA (in µg/L) in the maternal serum at delivery (1.15 (0.96-1.37), 8.20 (7.01-9.58), 3.43 (3.01-3.90), and 0.76 (0.69-0.85), respectively) were significantly lower than at 16 weeks (1.33 (1.11-1.58), 11.57 (9.90-13.53), 4.91 (4.32-5.59), and 0.99 (0.90-1.1), respectively), but higher than in cord serum (0.61 (0.51-0.73), 3.32 (2.84-3.89), 2.85 (2.51-3.24), and 0.49 (0.44-0.54), respectively) (P <0.01). Conclusions. The results suggest that PFCs transfer from the mother to the fetus during gestation. Future research to evaluate the potential health impact of gestational exposures to PFCs is recommended.

Abstract Number	**O-2-17-02**
Presenter	Anders Glynn*, Marie Aune, Sanna Lignell, Per-Ola Darnerud
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Nursing and Weight Gain Markedly Influence the Levels of PCB 153 in Blood of 4, 8 and 12 Year Old Children

Background and Aims: WHO recommends full nursing of infants for 6 months. Infants are exposed to lipid-soluble PCB in breast milk. To what degree does nursing affect blood levels of PCB in children? Methods: PCB 153, marker of total PCB, was measured in blood serum from 37 first-born children (4, 8 and 12 years old), in maternal serum during pregnancy week 32-34 and 4-12 years after delivery, and in breast milk 3 weeks after delivery. A detailed questionnaire about breast-feeding was answered. Associations between blood PCB 153 levels and breast-feeding were analyzed by multiple linear regression. Results: The women had nursed (both full and partial) their children in total for 20 months (mean, range 0-51). Maternal mean PCB 153 serum level decreased from 63 ng/g lipid to 33 ng/g lipid during follow-up (paired t-test, p<0.001). The largest decrease was seen for women sampled 12 years after their first delivery (mean: 55%, range: 26-82; N=15). After adjustment for follow-up time and BMI change, serum PCB 153 levels decreased 1.0% per month (SE: 0.23) of any nursing (p<0.001). Mothers had breast-fed their first-born child full-time for 4 months (mean, range 0-12). Partial nursing was reported to 4 months (mean, range 0-11). 4 year old children had the highest mean serum PCB 153 level (N=6; 47 ng/g lipid), followed by 8 year old (32 ng/g lipid; N=15, t-test: p=0.18), and 12 year old children (21 ng/g lipid; N=16, p=0.037). Child serum PCB 153 level increased with 2.7 ng/g lipid (SE: 0.64) per month of full breast-feeding (N= 36; p<0.001), and with 2.3 ng/g lipid (SE: 0.68) per month of partial breast-feeding (p<0.002). The CB 153 level decreased 1.2 ng/g lipid (SE: 0.34) per kg increase in child body weight (p=0.002), and increased 0.15 ng/g lipid (SE: 0.15) per ng PCB 153/g lipid increase in breast milk (p=0.078). The regression model explained 73% of the variation of child PCB 153 levels. Conclusions: Nursing strongly influenced child PCB 153 body burden. Weight increase during childhood diluted the PCB 153 accumulated during the nursing period.

Abstract Number	**O-2-17-03**
Presenter	Susan M. Pinney, Robert L. Herrick*, Robert Bornschein, Antonia M. Calafat, Kayoko Kako, Frank M. Biro, Paul Succop
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Exposure to Polyfluroalkyl Compounds in the Mid Ohio River Valley and Associations with Consumption of Ohio River Water

Background: Polyfluroalkyl compounds (PFCs) are bioaccumulative; health effects may include impaired liver function, cholesterol metabolism, pubertal development and cancer. An industrial plant in Parkersburg, WV discharged PFCs into the Ohio River beginning in 1980; elevated PFCs were detected in Ohio River water samples in 2009. Communities immediately downstream of the Parkersburg plant and a cohort of girls in Cincinnati, OH have elevated serum PFOA. Aims: Determine serum PFC concentrations in the Ohio River Valley population and identify potential exposure modifiers. Methods: Participants were recruited around Huntington, WV, Portsmouth, OH and Cincinnati, OH from May 2009 to January 2012, and provided water consumption, health effects, and residential history data. Water sources were identified through records searches and meetings with utilities. Serum samples were analyzed for 11 PFCs. Associations between serum PFC and recruitment site, sex, age, sample collection time, drinking water source, water consumption and water filter use were analyzed using ANCOVA. Results: Participants (N=370) were 2-85 years old, 72% female and 96% Caucasian, and used the Ohio River/Ohio River Aquifer as a drinking water source from 0 to 30+ years. 96% of participants drank tap water; 87% drank some bottled water. PFHxS (median=1.4ng/mL), PFNA (median=1.2ng/mL), PFOA (median=8.1ng/mL) and PFOS (median=7.1ng/mL) were detected in >99% of participants; PFDeA and Me-PFOSA-AcOH (medians=0.2ng/mL) were detected in >50%. All site median values for PFOA serum concentration (Huntington=7.8ng/mL; Portsmouth=8.8ng/mL; Cincinnati=6.1ng/ml) were above the 2009-2010 NHANES 90th percentile. Preliminary analysis found a significant association between serum PFOA level and years of using the Ohio River as a water source. Conclusions: Ohio River Valley residents have elevated PFOA exposure, but not other PFCs, in line with other studies. These findings suggest a major component of PFOA exposure is drinking water from the Ohio River.

Abstract Number	**O-2-17-04**
Presenter	Corinne Mandin*, Fabien Mercier, Jean-Paul Lucas, Olivier Ramalho, Olivier Blanchard, Nathalie Bonvallot, Gaelle Raffy, Erwann Gilles, Philippe Glorennec, Barbara Le Bot
Exposure	persistent organic pollutants
Health domains	neurodevelopment
Type of research	exposure measurement

Semi-volatile organic compounds in home settled dust: a nationwide survey in France

Background. Semi-volatile organic compounds (SVOCs) are of concern due to their possible health effects and the widespread exposure through different environmental media and pathways. Among them, ingestion of settled dust in indoor environment is likely to be a non-negligible contributor to exposure, and especially for children due to their hand-to-mouth behavior. Indoor concentrations need to be further described to better characterize children exposure. Aims. This study aims at determining the settled dust concentrations of around 50 SVOCs in a nationwide sample of French dwellings occupied by at least one child aged 6 months to 6 years. Methods. Vacuum bags were collected in 300 dwellings on the occasion of a nationwide survey (2008-2009). Bags containing dust from other sources than indoor, not containing enough dust after sieving to <100 µm, or not properly stored during transport were discarded. 145 samples were finally analyzed. The samples were extracted by pressurized liquid extraction with dichloromethane, and then analyzed by gas chromatography coupled with mass spectrometry (GC/MS) or tandem mass spectrometry (GC/MS/MS). Results. Phthalates (BBP, DBP, DEHP, DiBP, DiNP), bisphenol-A, galaxolide and phenanthrene were detected in 100% of dwellings. Median concentrations were respectively equal to 13.8; 13.0; 363; 28.9; 152; 4.5 µg/g of dust, 720 and 264 ng/g of dust. The maximum concentrations (above 1 mg/g of dust) were measured for four phthalates (DEHP, DiNP, DiBP, BBP) and permethrin. Some pesticides (aldrin, endrin, dichlorvos) and some polybrominated flame retardants (BDE-28,-85,-119 and -154) were detected in less than 10% of the dwellings. Conclusion. This is the first study that provides SVOC concentrations in house dust in a large sample of French dwellings. These concentrations confirm the presence of many SVOCs. The data will now be used to assess children exposure.

Abstract Number	**O-2-17-05**
Presenter	Paloma Beamer*, Alicia N. Waltz, Ann Marie A. Wolf, Eric Lutz, Eric A. Betterton
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Concentration of Volatile Organic Chemicals in Small Businesses Located in a Low- Income Latino Community

Background: Although preventable, occupational disease is one of the leading causes of death in the United States, with a disproportionate burden faced by minorities. Small businesses pose a particular risk. They are more likely to employ low-wage minority workers, and often use solvents containing volatile organic chemicals (VOCs) that can cause asthma, cancer, cardiovascular, and neurological disease. These businesses are often minority owned and lack access to culturally and linguistically appropriate occupational health and pollution prevention information due to economic, physical and social factors. Aims: Our objective was to characterize workers' exposure to VOCs in high-risk small businesses. The study was completed in the marginalized, predominately Latino, area of southern Tucson and focused on these business sectors: 1) auto repair and maintenance, 2) hair and nail salons, 3) print, and 4) woodworking shops. Businesses were recruited via promotoras. A photo-ionization detector, calibrated with isobutylene, was used to measure real-time VOC concentration for approximately 1 hour in 15 businesses. Results: The mean time-weighted average was 15, 5.8, 9.0 and 16 ppm for the auto-repair and maintenance, hair and nail salons, print, and woodworking shops, respectively. However, there was much variability within each sector and there was no significant difference between the sectors. The woodworking sector had the lowest (1.9 x 10-1 ppm) and the highest (3.3 x 101 ppm) mean concentrations, as well as the highest peak concentration (9.9 x 102 ppm). Peak exposures were associated with specific tasks at each business. The concentrations reported in this study are higher than those reported in previously published studies. Conclusions: The results of this study indicate that larger studies are warranted to better characterize the highly variable exposures of this at-risk population and identify tasks associated with peak exposures for intervention development.

Abstract Number	**O-2-17-06**
Presenter	Robin Dodson*, Ruthann Rudel
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure modeling

Indoor exposure to SVOCs from consumer products and building materials: Empirical data validates air-dust partitioning models and informs measurement strategies

Background: Residential exposures can dominate total exposure for a variety of commercial chemicals of health concern, including flame retardants and some phthalates and pesticides. Yet methods for assessing household exposures to these and other semivolatile organic compounds (SVOCs) in large studies are limited. Aims: 1) Validate Weschler and Nazaroff's theoretical partitioning model relating indoor air and dust concentrations using empirical data for 83 SVOCs, and 2) recommend indoor exposure measurement strategies. Methods: We simultaneously collected indoor air and dust samples in 170 homes and analyzed for 108 SVOCs, including phthalates, flame retardants, pesticides and PAHs. We use these data to validate a theoretical partitioning model relating indoor air and house dust concentrations. We then present factors to consider when selecting measurement strategies in exposure or health studies. We review strengths and weaknesses of dust wipes, vacuum dust, active air, and passive air sampling. Results: For model validation we used data on 47 SVOCs simultaneously detected in dust and air in at least one home and 22 detected in 50% of air and dust samples. Most were significantly positively correlated between air and dust. Ratios of measured dust and air concentrations span 6 orders of magnitude. As expected, compounds with higher log Koa have lower air concentrations relative to dust and lower detection frequencies in air. Predicted concentrations were reasonably correlated with measured (R2 ~ 0.8), with PAHs generally under-predicted whereas phthalates were more variable. Conclusions: Partitioning models allow air concentrations to be predicted from dust concentrations or the reverse. Taken together with expected concentrations, the models can be used to determine detection limits for sampling and to evaluate the potential utility of passive air sampling, which may be a promising exposure assessment strategy for large scale health studies because it can be deployed by participants and provides a more standardized measure than dust samples.

Abstract Number	**O-2-18-01**
Presenter	Stefan Reis*, George Morris, Lora E. Fleming, Sheila Beck, Mathew White, Michael H. Depledge
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Developing a modified conceptual model for health impact assessment towards Ecological Public Health

Background Methodologies for risk and impact assessment of human and environmental health effects often incorporate the use of conceptual models for problem framing and for the identification and evaluation of interventions. As the understanding of the intricate relationships between human health and the environment grows - particularly with regard to humans as part of ecosystems - the need for integration across scientific and professional disciplines and policy communities increases. Aims Through linking environmental health and ecosystem services, we aim to address inefficiencies introduced by discipline and policy barriers and so foster mutual understanding and improvements to human health and well-being. Methods/Results We propose the “Ecosystem-Enriched Driver-Pressure-State-Exposure-Effect (eDPSEEA) model,” to overcome the fragmentation of scientific disciplines and policy areas. It recognises positive and negative connections between the health of both humans and the environment. eDPSEEA incorporates socio-economic and other contextual modifiers of exposure and exposure-effect relationships, and recognises the importance of feedback-loops, trade-offs, and synergies between actions. As an illustration, we discuss how air pollution effects on human health and wider implications can be addressed using eDPSEEA. Conclusions Using the example of air pollution, we highlight the need to account for second order effects on human health via ecosystem services. Furthermore, we show socio-economic context is vital to account for distributional effects and modifiers for exposure-effect-relationships. We also recognise the potential for positive health and well-being effects (e.g. through green or blue space). Quantifications of effects which omit these positive aspects are potentially misleading, wrongly implying an overall reduction in societal welfare. Also it is vital to considerwhere measures to address an issue may create new problems.

Abstract Number	**O-2-18-02**
Presenter	Morton Lippmann*, Lung-Chi Chen, Terry Gordon
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Coherence of Toxicology and Epidemiology Findings in NYU NPACT Study

Background: Ambient PM2.5 is associated with adverse health effects, but the roles of chemical components as causal factors are less clear. NYU's HEI-sponsored NPACT Study included: 1) 6-month inhalation exposures of mice to concentrated (8-10X) ambient PM2.5 (CAPs) at 5 U.S. sites; 2) short-term exposures of cells in vitro and lung aspiration exposures in vivo to PM10-2.5, PM2.5-0.2, and PM0.2 (same 5 sites); 3) time-series studies of daily mortality and hospital admissions (150 U.S. cities); and 4) annual mortality (100 U.S. cities-American Cancer Society cohort). Methods: Mice were exposed to CAPs or filtered air 6 hr/d, 5 d/wk. Measurements were made of: continuous cardiac function (by implanted EKG monitors); intermittent aortic plaque coverage by ultrasound; ROS production and mRNA levels in vascular endothelial and airway epithelial cells exposed in vitro; and spontaneous heartbeat frequency in vivo. PM2.5 and component concentrations were regressed against: daily mortality and hospital admissions by cause in time-series studies; and against annual cardiovascular disease (CVD) and lung cancer mortality. Results: Variations in aortic plaque progression by geographic region were coherent with variation in ischemic heart disease (IHD) mortality (ACS cohort), with both primarily attributable to coal combustion. Daily hospital admissions were associated with OC, EC, Cu from traffic and Ni and V from residual oil, daily mortality with SO4=, Se, and As, and cardiac function in the mice with Ni, Al, EC, P, S, and V. Conclusions: We demonstrated coherence for CVD effects in humans and mice for both acute and cumulative responses to PM2.5 components, with coal combustion being the major factor responsible for annual IHD mortality and aortic plaque progression.There was coherence for transition metals (Ni, Cu, and V) being most closely associated with daily hospital admissions and Ni and V with short-term cardiac function changes in mice.

Abstract Number	**O-2-18-03**
Presenter	Marko Tainio*, Grzegorz Teresinski, Audrey de Nazelle, Mark J Nieuwenhuijsen
Exposure	others
Health domains	other
Type of research	health impact assessment

Disability-adjusted life years (DALYs) for transport injuries

Background: Health impact assessment (HIA) studies are increasingly combining adverse health effects of different stressors. Injuries, caused by transport accidents, is one such stressor. In recent HIA studies, transport injuries have been combined with the health effects of air pollution, noise and physical activity. To be able to combine injuries with disease driven health effects, a common health indicator is needed. Aims: In this study, we estimate the average DALY (disability-adjusted life year) loss of one person injured in transport accident. Methods: Years Lost due to Disability (YLD), one of two components of DALYs, were calculated for 2007-2011 using the Swedish Traffic Accident Data Acquisition (STRADA) database. In STRADA, injuries were recorded with Abbreviated Injury Scale (AIS) codes. These AIS codes were aggregated to injury types and YLDs were calculated by multiplying the number of injuries with disability weights and the average duration of these injuries. Resulting YLDs were estimated separately for different gender, mode of transport and location of the accident. Results: Average YLD loss per person was 0.4 YLDs and 0.2 YLDs for males and females, respectively. For different modes of transport, the highest average loss of YLDs was for motorcycles (0.8 YLDs per person) and lowest for pedestrians (0.2 YLDs per person). Accidents in urban areas were on average 50% less serious than accident in rural areas. Conclusions: The results show that shifting modes of transport will also change the severity of injuries, and this change is significant enough to have impacts on HIA studies. The results of this study can be used to assess the burden of disease in HIA studies that assess the changes in transport modes.

Abstract Number	**O-2-18-04**
Presenter	Hans Orru*, Boel Lövenheim, Christer Johansson, Bertil Forsberg
Exposure	ambient air pollution
Health domains	no health domain
Type of research	health impact assessment

Assessing the health benefits of decreased population exposures versus disbenefits of increased driver exposures in an 18 km long high-way road tunnel by-pass i

Background: To meet increased needs of transports, a 21 km long by-pass (18 km in a tunnel) is planned. The by-pass is expected to reduce traffic emissions in central Stockholm but at the same time tunnel drivers could be exposed to high concentrations of vehicle exhaust and road dust. Aims: The main objective of this study is to estimate the balance between expected health benefits for the general population associated with improved ambient air quality and the expected adverse effects for tunnel users from additional exposure. Methods: For the exposure reduction, the change in annual ambient NOX and PM10 levels were modelled using 100x100 m grids and the population (1 628 528 inhabitants) average exposure was calculated for Greater Stockholm area. The tunnel exposure was estimated based on annual average NOX and PM10 levels, time spent in tunnel and number of persons using the tunnel. Health risks were calculated based on health impact assessment principles using equations and AirQ software. In calculations the following E-R coefficients for non-external mortality were used: 8% per 10 µg/m3 increase of NOX and 1.68% per 10 µg/m3 increase of coarse (non-exhaust) PM10. Results: It appeared that for the general population there would be annually 23.0 (95% CI 17.2–31.3) premature death less; mainly from traffic exhaust (indicated by NOX) and somewhat from coarse particles (indicated by PM10), contributing 22.5 and 0.5 fewer deaths, respectively. At the same time, tunnel users (daily 55 219 cars each way) will be exposed to NOX concentrations up to 1957 µg/m3 during rush-hours. Passing the whole tunnel daily would correspond to an additional annual NOx exposure of 9.6 µg/m3 and PM10 exposure of 4.1 µg/m3. Assuming there would be 1.3 persons in car from the age 30–74, this exposure would result in 22.9 (95% CI 17.2–31.3) preterm deaths. If there would be more persons per car or older people travelling, the effect could be adverse. Conclusions: Depending on the exposure of tunnel users, the effect can be beneficial or adverse.

Abstract Number	**O-2-18-05**
Presenter	Giorgio Assennato*, Roberto Giua, Stefano Spagnolo, Tiziano Pastore, Angela Morabito, Annalisa Tanzarella, Maria Serinelli, Vito Laghezza, Lucia Bisceglia, Francesco Cuccaro
Exposure	ambient air pollution
Health domains	cancer
Type of research	health impact assessment

Risk assessment on Taranto (Italy) integrated steel works

Background. Lack of coverage of environmental health issues in the Integrated Pollution Prevention and Control Permit (IPPC) of a large integrated steel works resulted in the intervention of criminal law court whose epidemiological experts proved a causal association between steel emissions and both short term and long term health effects leading to the administrative seizure, risk of job loss of 12000 blue collars and interinstitutional conflict. As a consequence a regional act required that an environmental health assessment should be carried out including an epidemiological evaluation and a risk assessment (subject of the current paper). Aims. Evaluation of the overall inhalation cancer risks due to emissions before and after a new IPPC permit. Methods. 183 stack emissions and 5 diffuse sources were taken into account for specific carcinogenic pollutants (PAHs, Benzene, Dioxins, PCBs, As, Cd, CrVI, Ni, Pb). Annual average concentrations, for both before and after IPPC permit, were estimated through a modeling system including a diagnostic meteorologic model (SWIFT), a turbulence preprocessor (SURFPRO) and a Lagrangian particle dispersion model (SPRAY). From estimated concentrations and using the equations proposed by the California OEHHA Air Toxics Hot Spots Risk Assessment Guidelines, the inhalation dose for each pollutant was calculated and then multiplied by specific inhalation slope factor to get life-time cancer risk for each pollutant. The individual pollutant cancer risks were then added up to provide the overall plant inhalation cancer risks plotted in a GIS map. Results. It was calculated that 22.516 and 12.078 inhabitants (out of 200.000), respectively in the before and after IPPC scenarios, had an additional life-time risk of cancer d higher than 1:10.000. Conclusions. This assessment shows the efficacy of IPPC permit reduced emissions resulting in decreased lifetime cancer risks in the town population, even though there is a still a residual risk to be managed.

Abstract Number	**O-2-18-06**
Presenter	Liliana Cori*
Exposure	others
Health domains	ethics
Type of research	review

Ethical aspects in Health Impact Assessment (e*)

Health Impact Assessment, HIA is intended to contribute to public health by allowing those who make decisions on behalf of the public to anticipate how those decisions will affect people's health. It is a combination of procedures, methods and tools to be adapted in different contexts to evaluate projects, plans, and policies. The premise of HIA is thus the possibility to foresee impacts; the same is true for Environmental Impact Assessment, as well as Strategic Environmental Assessment. The difference is the inclusion of humans as subjects: local communities often require HIA where high impacts are present or suspected, because HIA produces numbers relating to people that could impact their lives. Here we find the first ethical implication of HIA. It is a decision support tool, based on the inclusion of communities in HIA design and process development; the inclusion of non-expert knowledge is foreseen by HIA methods through both quantitative and qualitative data collection and evaluation. The roles of actors have to be considered, and their ethical duties linked to their responsibility. In addition, the power vested of assessors and decision-makers also needs to be considered. The ethical duty of assessors is to provide decision-makers with the information needed in order to make ethical decisions, describing existing inequalities, identifying positive and negative impacts under each option, and describing on whom these will fall. HIA involves multiple competencies, among which environmental epidemiology plays a central role. Ethical issues relate specifically to the hypothesis to be tested, which health impacts have to be considered, the scientific strength of evidence produced, the validity of results obtained, as well as the equity and equality considerations along the health-disease continuum. The ethical duty of decision-makers is linked to the responsibility to act and decide, supported by legislation, where the right of the public to information and participation is recognised, and by the practice of openness and transparency required by democracy.

Abstract Number	**O-2-20-01**
Presenter	Frauke Hennig*, Marcus Bauer, Marie Henrike Berg, Stefan Möhlenkamp, Susanne Moebus, Raimund Erbel, Karl-Heinz Jöckel, André Scherag, Barbara Hoffmann
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Chronic exposure to air pollution and progression of subclinical atherosclerosis in a population-based cohort study in West Germany

Background:Experimental evidence suggests that chronic exposure to inhalable fine particles contributes to the development and progression of atherosclerosis.Epidemiological studies are scarce and mostly limited to cross-sectional data. Aim:To investigate the association of fine PM (PM2.5 and PM10) with yearly change in common carotid artery intima media thickness (CIMT) in a general population. Methods and Material:We used data from the first (2000-2003) and second (2006-2008) examination of the Heinz Nixdorf Recall Study, a German cohort of 4814 participants aged 45 to 75 years at baseline. CIMT was measured at the far wall proximal to the bulb using semiautomatic computer software. We present side-specific yearly change in CIMT and used linear regression models to assess the association of fine PM with yearly change of CIMT, controlling for age, sex, education, smoking status, LDL/HDL, intake of statins, physical activity, BMI and small area socio-economic status. Additionally we tested side-specific differences with a multivariate approach in the subgroup with available CIMT data on both sides. Results: Our complete case analysis included 2209 participants (left), 2708 (right) and 1762 (both sides). Yearly mean (±SD) CIMT change was 25.5 (±31.6) µm (left) and 21.5 (±28.6) µm (right). We observed a positive association of PM2.5 with progression of left CIMT with a mean increase of 3.70 µm (95%-CI: 1.72; 5.69) per 2.38 µg/m3 increase in PM2.5 and a weaker association on the right side (1.37 µm (95%-CI: (-0.44; 3.17)). Multivariate analysis yielded an overall effect for PM2.5 and also side-specific differences (p=0.03). Results for PM10 were similar. Conclusions:Our results suggest that urban fine PM is associated with atherogenesis. Explanations for side-specific differences could be different turbulence patterns due to anatomical conditions. This study was funded by the German Research Council (DFG; HO 3314/2-1).

Abstract Number	**O-2-20-02**
Presenter	Luz T Padró-Martínez*, Emmanuel Owusu, Ellin Reisner, Wig Zamore, Mkaya Mwamburi, Doug Brugge, John L Durant
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Impact of In-home Air Filtration on Particle Number Concentration and Blood Biomarkers of Cardiovascular Disease for People Living Close to a Major Highway

Background: Epidemiology suggests that people living close to highways are at increased risk of cardiovascular disease (CVD) and mortality. Exposure to traffic-generated ultrafine particles (<100 nm; UFP) may be a risk factor. One means of reducing indoor exposure to UFP is by air filtration with high efficiency particle arrestance (HEPA) filters. Aims: We conducted a community-based, pilot-scale study of HEPA filtration in public housing near Interstate 93 (I-93) in Somerville, MA (USA) to assess the feasibility of air filtration to reduce UFP exposure and blood biomarkers of CVD. Methods: A total of 21 residents (20 homes) living <200 m from I-93 participated in a randomized, single blind crossover study. Each participant (≥40 years old) served as their own control. A window-mounted HEPA filter and a particle counter (4-3,000 nm particles) were installed in participant living rooms for 6 weeks with each participant exposed to filtered air for 3 weeks and unfiltered air for 3 weeks. Blood was collected at the start, crossover, and end of the trial and analyzed for CRP, IL-6, TNFα-RII and fibrinogen. Participant health, diet, and time-activity patterns were surveyed. Results: HEPA filtration reduced particle number concentrations (PNC) by at least 20-68% in most of the living rooms. Higher PNC removals occurred when windows remained closed. PNC reductions were less than expected, perhaps because of living room size and proximity to indoor PNC sources (e.g., kitchen). After adjustment for baseline biomarker levels, we did not observe significant differences($p<0.05$) in the biomarkers due to HEPA filtration. Conclusions: We did not find evidence that reduced UFP levels positively affected blood biomarker levels. This pilot study suggests that larger reductions in residential UFP and larger study populations are needed.

Abstract Number	**O-2-20-03**
Presenter	Syed Shah*, Azad Khan, Qayyum Noorani
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

Role of High-altitude in hypertension: from Mountain Villages of Pakistan to Plains of United Arab Emirates

Aimes: This study was conducted to determine the prevalence of hypertension in adult population living at an altitude of , in Himalayan villages of Pakistan compared to their Pakistani, Arab and Emirati counterparts living at sea level in United Arab Emirates (UAE). Methods: This was a cross-sectional study. A population-based random sample of South Asian , Arabs and native Emirati adults were selected in Al Ain (n=2022) UAE, and Ghizar (n=2000), Northern Areas of Pakistan as part of a global health study in 2011-2012. Trained staff measured blood pressure (BP), height, weight, waist and hip circumference. Same standard weight and height measures scales (SECA) and Automated BP Monitors (Omron) were used in UAE and Pakistan. Hypertension was defined as greater than or equal to 140/90 mmHg. Obesity was defined as body mass index ≥30kg/m2 Results: The overall prevalence of obesity was 55% in immigrant Arabs, 44% in native Emiratis, 28% in immigrant Pakistanis, and 6% in high mountain population of Gihizar, Pakistan. The overall prevalence of hypertension was 33% in the high mountain population of Gizar, 28% in their Pakistani counterparts, 21% in immigrant Arabs and 14% in native Emiratis. Conclusions: People living at high altitude had a higher prevalence of hypertension compared to their counterparts living at sea level.

Abstract Number	**O-2-20-04**
Presenter	Tijs Louwies*, Luc Int Panis, Michal Kicinski, Patrick De Boever, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Microvascular Responses to Short-term Changes in Particulate Air Pollution in Healthy Persons

Background: The microcirculation plays an important role in the physiology of cardiovascular health. Air pollution is an independent risk factor for the development and progression of cardiovascular diseases, but the number of studies on the relation between air pollution and the microcirculation is limited. Aim: To examine the relationship between short-term changes in air pollution and microvascular changes. Methods: We measured retinal microvasculature using fundus image analysis in a panel of 84 healthy persons (52% women) aged 22 to 63y between January and May 2012. Blood vessels were measured as Central Retinal Arteriolar/Venular Equivalent (CRAE/CRVE). The median number of measurements was 2 (range: 1-3). We used monitoring data on particulate air pollution (PM10) and black carbon (BC). Mixed-effect models were used to estimate associations between CRAE/CRVE and exposure to PM10 and BC using various exposure windows. Results:CRAE and CRVE were associated with PM10 and BC concentrations, averaged over 24 hours before the retinal examinations. For each 10 µg/m³ increase in PM10, CRAE narrowed by 0.93 µm (95% CI: -1.42 to -0.45; p=0.0003) and CRVE decreased with 0.86 µm (95% CI: -1.42 to -0.30; p=0.004). For each 1 µg/m³ increase in BC, CRAE decreased with 1.84 µm (95% CI: -3.18 to -0.51; p<0.001). The reported associations were adjusted for individual characteristics and time varying conditions such as ambient temperature. Conclusions: The retinal microvasculature responds to short-term changes in air pollution levels. These results suggest a mechanistic pathway through which air pollution could act as a trigger of cardiovascular events.

Abstract Number	**O-2-20-05**
Presenter	Silas Bergen*, Christopher Paciorek, Adam Szpiro
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	others

Optimal smoothing parameter selection to minimize exposure measurement error in air pollution

Background: Exposures in air pollution cohort studies are typically predicted from monitoring data in a first-stage model that combines land-use regression with spatial smoothing. Predicted exposures are used in a second-stage health model. The difference between true and predicted exposures is a form of measurement error. The degree of spatial smoothing is determined by a penalty parameter. A larger penalty parameter implies a greater degree of smoothing, such that only large-scale spatial features of the exposure surface are reproduced, but with less variability than in a model with a smaller penalty parameter. Traditional approaches select the penalty parameter to optimize the fit and predictive accuracy of the first-stage model. Our goal is to develop methods that select the penalty parameter to improve estimation of the health effect parameter. We focus on low-rank kriging and thin-plate splines. Methods: We show that a larger penalty induces Berkson-like measurement error from missing exposure surface characteristics and a smaller penalty induces classical-like error resulting from more variable exposure model coefficients. With finite monitoring data, both types of error can induce bias. We propose a new criterion for penalty parameter selection based on characterizing the impact of each measurement error component and minimizing their contributions to the health effect error. We illustrate our methodology in simulation studies and in an analysis of PM2.5 and systolic blood pressure in the NIEHS Sister Study. Results: Our approach to penalty parameter selection leads to less biased and more accurate health effect estimates than standard techniques based on restricted maximum likelihood (REML) or generalized cross-validation (GCV). Conclusion: Inference in air pollution cohort studies can be improved by selecting the first-stage exposure model to improve estimation of the health effect parameter in a second-stage model.

Abstract Number	**O-2-20-06**
Presenter	Jennifer Bobb*, Gregory A. Wellenius, Murray A. Mittleman, Brent A. Coull
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Bayesian kernel machine regression for estimating the health effects of multi-pollutant mixtures

Background: It is well accepted that humans are routinely exposed to multiple pollutants simultaneously, but, partially due to lack of flexible statistical methods, most epidemiological studies either focus on pollutants one at a time or apply simple interaction models. Aims: To develop statistical methodology that flexibly quantifies the health effects of multi-pollutant mixtures. We sought an approach that allows for complex non-linear and non-additive effects while identifying potentially harmful components of the mixture. Methods: We implemented Bayesian kernel machine regression (BKMR) with variable selection to quantify the effects of a multi-pollutant mixture on health. This approach regresses an outcome on a nonparametric term involving a high-dimensional vector of exposure variables specified by a kernel function. The model includes component-specific binary parameters reflecting whether each component should be included in the kernel function. We evaluated the performance of BKMR under realistic exposure-response scenarios via simulation, and illustrated the method by applying it to data on air pollution mixtures and blood pressure in the Boston-area MOBILIZE cohort study. Results: Our simulation study considered three different four-pollutant scenarios: (1) nonlinear effect of a single component, (2) non-additive but linear effects of two components, and (3) non-additive and non-linear effects of two components. A regression comparing the true exposure-response term and the nonparametric term estimated by BKRM using all four pollutants as inputs yielded R2 values of 0.94-0.99 for all scenarios. The method yielded high posterior probabilities of inclusion for the harmful components (>0.8) in all cases, and low inclusion probabilities for unimportant components (<0.8 for all, with 75% below 0.4). Conclusions: This study suggests BKRM with variable selection is a promising statistical approach for flexibly quantifying the health effects of multi-pollutant mixtures.

Abstract Number	**O-2-22-01**
Presenter	Halina Rollin*, Jon Ø. Ødland, Torkjel M. Sandanger, Kalavati Channa, Tahira Kootbodien, Penelopi Theodorou
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	exposure measurement

EVALUATION OF PRENATAL EXPOSURE TO PERSISTENT TOXIC SUBSTANCES (PTS) IN SELECTED REGIONS OF SOUTH AFRICA.

Background: There is a paucity of investigations into exposure to environmental contaminants (PTS) in general population but especially in the pregnant women in the Southern Hemisphere. Exposure to environmental toxicants places pregnant women and the developing foetus at the highest risk. Over last 6 years, under auspices of Arctic Monitoring and Assessment Programme (AMAP), a number of studies investigating exposure and birth outcomes were performed in South Africa. Aims: The purpose of the studies was to investigate prenatal exposure to selected toxic elements and pesticides in different regions of South Africa. Methods: In total 650 pregnant women presenting for delivery at the local hospitals situated in different regions of the country participated in these studies. Paired blood samples were collected from mother prior to delivery and cord blood after delivery. Selected elements and organic compounds were analysed using ICP/MS and GS/MS respectively. Data from socioeconomic questionnaires and birth records were also collected. Results: Most of the toxic elements measured were detected in both maternal and paired umbilical cord blood, some in elevated concentrations. High concentrations of DDT and its metabolites in maternal plasma were measured in malaria endemic sites. The high levels of banned γ-HCH and endosulfan (1 and 2) were found in maternal plasma samples in predominantly agricultural sites. For most of the compounds measured, significant differences between regions were found. Predictors of elevated levels for compounds measured were identified. Conclusion: Study found prenatal exposure to high levels of banned substances in some regions of South Africa which is of concern, particularly in view of future climate change and food security. Results of these studies inform policy and regulatory agencies.

Abstract Number	**O-2-22-02**
Presenter	Joseph Braun*, Allan C. Just, Paige Williams, Kristen Smith, Antonia M. Calafat, Russ Hauser
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Personal care product use and urinary paraben and phthalate metabolite concentrations during pregnancy among women from a fertility clinic

Background: Parabens and phthalates, used in personal care/beauty products, are potential endocrine disruptors and the developing fetus may be sensitive to these chemicals. Aim: To determine if personal care product use during pregnancy is associated with paraben and phthalate exposure. Methods:We measured urinary butyl-paraben (BP), methyl-paraben (MP), propyl-paraben (PP), mono-n-butyl phthalate (MBP), and monoethyl phthalate (MEP) concentrations up to three times during pregnancy in 177 women attending a fertility clinic in Boston MA. Women reported their use of 13 types of personal care products in the previous 24 hours using a standardized questionnaire. We used linear mixed models to examine the association between personal care product use and specific gravity normalized paraben and phthalate metabolite. Results: Lotion, cosmetic, and perfume use were positively associated with phthalate and paraben molar sums, although the magnitude of individual biomarker increases varied by product. Women who used lotion had BP, MP, and PP concentrations 2-3 times as high as non-users, whereas MBP and MEP concentrations were 28% (95% confidence interval [CI]: 2, 62%) and 50% (CI:11, 103) higher, respectively. Cosmetic users had higher BP (89%; CI:21, 198), MP (66; CI:17, 137), PP (105%; CI:31, 220) and MEP (53%; CI: 9, 113%) concentrations compared to non-users. Women using perfume had MEP concentrations 167% (CI: 98, 261%) higher than non-users, but modest increases in MP and PP concentrations (45-48%). We observed monotonic dose-response relationships between the total number of products used and individual biomarker and summary concentrations. These results were robust to adjustment for sociodemographic factors, season, or time of day of sample collection. Conclusions: Several personal care products were associated with higher urinary paraben and phthalate concentrations among pregnant women. Both biomonitoring and questionnaire data may be useful for assessing pregnant women's exposure to the chemical mixtures found in some personal care products.

Abstract Number	**O-2-22-03**
Presenter	Susanne Breitner*, Alexandra Schneider, Cavin Ward-Caviness, Robert B. Devlin, David Diaz-Sanchez, Lucas M. Neas, Prakash Bhave, Wayne E. Cascio, Annette Peters, William Kraus
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Associations between short-term exposure to PM2.5 and metabolite levels

Background: Air pollutants such as particulate matter (PM) have been associated with cardiovascular disease (CVD). However, the mechanisms linking PM exposure to CVD remain poorly understood. Aims: This study aims to explore associations between short-term exposures to PM with a diameter < 2.5 µm (PM2.5) and changes in the plasma concentrations of metabolites. Methods: We used cross-sectional data from a large CVD cohort in North Carolina (NC), USA, between 2001 and 2008. Blood samples were taken from individuals undergoing coronary artery catheterization at a medical center. Mass spectrometric profiling of 60 amino acids and acylcarnitines was performed in fasting plasma samples. Daily average concentrations of PM2.5 mass in each NC census tract were obtained from a Bayesian space-time hierarchical model that fuses observed and modeled PM2.5 concentrations. Residential addresses were given the exposure as estimated at the closest census tract centroid, measured by perpendicular distance. Daily meteorological data were obtained from a monitoring network. Associations between metabolites and PM2.5 were analyzed using linear regression models adjusting for long-term trend and seasonality, calendar effects, meteorological parameters, age, gender and smoking. Results: Data for analysis were available from 2707 individuals. Preliminary results point to associations between increased PM2.5 levels and changes in eight metabolites with a delay of one to four days. For example, an increase of 10µg/m3 in PM2.5 with a lag of two days was associated with a 9.3% increase in mean plasma methionine concentrations (95% confidence interval [95% CI]: 3.2%-15.5%), corresponding to an absolute increase of 2.29 µM (95% CI: 0.79-3.78 µM). This association remained significant after correcting for multiple testing. Conclusions: Results suggest that short-term exposure to ambient PM is associated to changes in plasma concentrations of metabolites in a population of patients with CVD. This proposed abstract does not necessarily reflect EPA policy.

Abstract Number	**O-2-22-04**
Presenter	Gurusankar Saravanabhavan*, Ellen Lye, Kate Werry, Nellie Roest, Douglas Haines
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Baseline levels of selected environmental chemicals in Canadians: Results from Canadian Health Measures Survey

Background: The Canadian Health Measures Survey (CHMS) is an on-going nationally representative direct health measures survey launched in 2007. This survey collects new and important data to fill knowledge gaps on health status of Canadians. The biomonitoring component of CHMS, supported by Canada's Chemicals Management Plan, collects and analyzes blood and urine samples for several classes of environmental chemicals. Method: Each CHMS cycle spans approximately two years in which about 5500-6500 individuals are selected representing about 96% of the general population in Canada. Respondents aged 6-79 years were selected for CHMS (2007-2009) while the subsequent CHMS cycles (CHMS 2009-2011; CHMS 2012-2013) include 3-5 years olds. The respondents completed a household interview and visited a mobile examination centre where the physical health measurements were performed and blood and urine samples were collected. Biomarkers for about 90 environmental chemicals were analyzed in the respondent's bio-specimens. Results: Descriptive statistics (arithmetic and geometric means, and selected percentiles) were computed on the levels of individual biomarkers in Canadians. Baseline levels of selected group of environmental chemicals (including heavy metals, pesticides and emerging contaminants) from CHMS 2007-2009 and 2009-2011 (to be released in April 2013) will be presented. These biomarker levels in Canadians will be compared with similar findings reported in other population surveys. Preliminary analysis on the temporal trends in the biomarker levels will be highlighted. Conclusion: Nationally representative data on the levels of biomarkers from CHMS provides valuable information for current and future human health risk assessments and for assessing potential links between chemical exposures and health outcomes. Moreover, it allows comparison of similar data from other countries and helps in monitoring temporal and geospatial trends in biomarker levels.

Abstract Number	**O-2-22-05**
Presenter	Park Kyung-Hwa*, Kim Hyun-Jeong, Yu Seunh-Do, Choi Kyunghee
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Korean National Environmental Health Survey, the first stage 2009-2011

Background and Aims Biomonitoring programs are useful for investigating human exposure to environmental chemicals as to make proper countermeasures or policies. The Korean National Environmental Health Survey(KNEHS) conducted every 3 years by National Institute of Environmental Research(NIER) is designed to collect data on the reference values for the general population. The objectives are to identify 1) the human exposure status of environmental contaminants 2) the geographical distribution and time trend and 3) the exposure factors. Methods By securing representative concentration of environmental chemicals while considering environmental exposure impact factors, the stratified sample design was used. Around 350 survey districts (total 3 years) had been selected among urban, rural and coastal areas and regions adjacent to air quality monitoring networks. The survey included questionnaire, sampling and instrumental analysis was conducted annually for 2,000 people. In order to analyze concentrations of environmental chemicals, blood and spot urine were obtained from the subjects. Results The 6,311 adults (2,928 males, 3,383 females) participated in this survey. The reference values and reference ranges for select chemicals (metals, phthalate metabolites, bisphenol-A, cotinine...) were announced as National Statistics in last year. In-depth analysis is ongoing, and more detailed data will be released. Conclusion/PerspectiveThis survey offers a unique opportunity to assess the levels of impregnation of the Korean population by many chemicals. The 2nd survey is currently underway starting from June 2012.

Abstract Number	**O-2-22-06**
Presenter	Andre Schutze*, Martin Kraft, Silvia Sievering, Hermann Fromme, Wolfgang Völkel, Thomas Brüning, Holger M. Koch
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	exposure measurement

Metabolites of the phthalate substitute DINCH in urine samples of children in Germany

DINCH (diisononylcyclohexane-1,2-dicarboxylate) is a high molecular weight phthalate substitute mainly intended for sensitive applications like toys and food contact materials. In this study we analyzed 148 spot urine samples from children (median age: 4.6 yrs (range 1.5-6.5 yrs; 78 male, 70 female; median body weight: 18 kg (range 11-39 kg)) of 19 different day care facilities, from urban and rural areas in West- and South-Germany collected in 2012. The samples were analyzed by on-line HPLC-MS/MS for the simple monoester and several oxidized metabolites of DINCH using isotope dilution quantification with limits of quantification at or below 0.1 µg/l. In almost all samples we detected oxidized DINCH metabolites (99%>LOQ). As expected the hydroxylated monoester (OH-MINCH) was the predominant metabolite followed by the oxo monoester (oxo-MINCH) and the carboxyl monoester (cx-MINCH). The simple monoester MINCH was detected only in 25% of the samples. The median (95th percentile) concentrations for OH-MINCH were 1.9 µg/l (10.7 µg/l), for oxo-MINCH 1.5 µg/l (8.2 µg/l) and for cx-MINCH 1.1 µg/l (5.6 µg/l). The metabolites correlated strongly among each other over the full concentration range spanning 3 orders of magnitude. Compared to urine samples from German adults collected in the same year urinary DINCH metabolite concentrations (median and 95P) were approximately 5 times higher in the children. DINCH has been introduced into the German market in 2002 as a safe phthalate alternative. With this study we can show that an omnipresent DINCH exposure has already reached German children, and that the children´s DINCH exposure seems to be higher than exposure of adults. DINCH exposures are still lower than exposures to the phthalates it substitutes (e.g. DEHP), but increasing DINCH exposures have to be expected. Due to its favored toxicological profile (over the phthalates) measured DINCH exposures do not seem to be associated with health risks to these children.

Abstract Number	**O-2-23-01**
Presenter	Medea Imboden*, Christian Schindler, Ashish Kumar, Ivan Curjuric, Harish C. Phuleria, Ming-Yi Tsai, Nino Kuenzli, Thierry Rochat, Florian Kronenberg, Nicole Probst-Hensch
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Genome-wide interaction study identifies Cadherin 13 as effect modifier of cumulative PM10 exposure on lung function decline.

Background: Evidence for differences in individual health response to air pollution exposure is abundant, but the mechanisms underlying these differences have remained elusive. Aims: We aimed to identify agnostically by genome-wide interaction association study (GWIS) genetic determinants that might modify the air pollution effect on lung function decline in an adult population-based sample. Methods: Two stage GWIS approach was performed. The discovery (N= 763) and replication sample (N=3896) were derived from the pool of the multi-centric SAPALDIA cohort study (Swiss Study on Air Pollution And Lung And heart Diseases In Adults). The air pollution measure used was cumulative PM10 (particulate matter with aerodynamic diameter ≤10 µm) exposure during the follow-up period obtained from a validated dispersion model applied to the participant's residential history. Complete information on lung function was available at baseline and follow-up examinations eleven years apart. Annual rate of decline in forced mid expiratory flow (FEF25-75) was the main endpoint. Results:We observed a cluster of variants in the CDH13 gene at 16q23.3 interacting with PM10 exposure on annual FEF25-75 decline. The strongest interaction was observed for rs2325934 (P=8.8x10-10). Replication of the top hit interaction was successful at P=0.0008. In sensitivity analyses, we found evidence for a three-way interaction between PM10, CDH13 genetic variants and weight gain on annual decline in FEF25-75. Conclusions: Our GWIS analyses reveal CDH13 as a biologically plausible modifier of PM10 effects on lung function decline, since CDH13 modulates airway inflammation. Cadherin 13 also modulates serum adiponectin level, a protein-hormone excreted by adipose tissue, modulating inflammatory and metabolic processes. Future studies are needed to confirm the effect modification of PM10 on lung function decline by CDH13 in independent populations and to clarify the role of obesity as an additional susceptibility factor.

Abstract Number	**O-2-23-02**
Presenter	Amar Mehta*, Gian Andri Thun, Medea Imboden, Ilaria Ferrarotti, Dirk Keidel, Nino Kuenzli, Hans Kromhout, David Miedinger, Maurizio Luisetti, Nicole Probst-Hensch
Exposure	gene-environment interactions
Health domains	respiratory disease
Type of research	cohort study

SERPINA1 PiMZ genotype, environmental and occupational exposure, and change in lung function

Background: Whether genetic predisposition for intermediate Alpha1-Antitrysin (AAT) deficiency modifies the association between environmental and occupational exposure and lung function decline is unknown Objective: We investigated interactions between SERPINA1 PiMZ genotype and outdoor exposure to particulate matter of 10 micrometers or less (PM10), and occupational exposure to vapors, gases, dusts or fumes (VGDF), on annual change in lung function in a population-based prospective cohort study of Swiss adults. Methods: Pre-bronchodilator spirometry was performed in 3,629 non-asthmatic Swiss adults ages 18-62 at baseline in 1991 and at follow-up in 2001-2003 for whom SERPINA1 genotypes were available. Linear mixed effect regression models of annual change in lung function during follow-up, with random intercept for study area, were used to evaluate multiplicative interactions between SERPINA1 genotype (PiMZ, PiMS or PiMM as reference) and outdoor PM10 (µg/m3) and VGDF exposure (high-level, low-level or no exposure as reference) during follow-up, after adjustment for potential confounders including smoking. Results: Statistically significant multiplicative interactions were identified between PiMZ genotype and high-level VGDF exposure on annual change in forced expiratory flow at 25-75% of forced vital capacity (FEF25-75%, ml/s/yr) ($p<0.0001$) and forced expiratory volume in 1 second over forced vital capacity (FEV1/FVC, %) ($p=0.04$). Annual declines in FEF25-75% (-90.0 ml/s/yr, 95%CI:-135.4, -44.3) and FEV1/FVC (-0.3%, 95%CI:-0.6, 0.0) in association with VGDF exposure were observed mainly in PiMZ carriers while no associations were observed in PiMS/PiMM carriers. Interactions between PiMZ genotype and VGDF exposure on annual declines in FEF25-75% and FEV1/FVC were limited to smokers. No interactions were identified between PiMZ genotype and outdoor PM10 exposure. Conclusions: SERPINA1 PiMZ genotype modified the association between longitudinal decline in lung function and VGDF exposure in smokers in this population-based sample of Swiss adults.

Abstract Number	**O-2-23-03**
Presenter	Tony Fletcher*, Lorna W Harries, Tamara Galloway, Berran Yucesoy, Michael Kashon, Michael Luster
Exposure	gene-environment interactions
Health domains	other
Type of research	cross-sectional study

Genetic and transcriptomic studies of PFOA and PFOS: thyroid hormones, lipid metabolism and transporter proteins

Background: Cross sectional analyses of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS) in exposed human populations show associations with serum cholesterol and thyroid hormones. Expression studies in relevant genes can provide supportive evidence for the biological activity of these compounds. Large variability in observed half life of these compounds may have a genetic component, in particular in relation to transporter proteins, such as organic anion transporters (OAT). Objectives: To assess the association of PFOA or PFOS exposure on the expression of genes related to cholesterol and thyroid hormone metabolism or transport, and the association of polymorphisms in transporter genes with PFOA and PFOS excretion half-life. Methods: In 2010 we took blood samples from adult volunteers in the C8 Science Panel study in the Mid-Ohio Valley, 755 for the polymorphisms analysis and 400 for the gene expression studies. We measured PFOA and PFOS levels at both 2005/6 and 2010. RNA samples were extracted for gene expression. The transcript expression of a panel of 12 lipid metabolism genes and 5 thyroid hormone synthesis or thyroid receptor genes was tested by quantitative real-time PCR, and regressed on serum PFOA or PFOS. Individual half-lives were estimated from falls in serum levels of PFOA and PFOS from samples collected in 2010-11 and 2005-06. GoldenGate chemistry was used to genotype single nucleotide polymorphisms in candidate transporter genes. Genotype distributions and allele frequencies were calculated, and the relations were assessed by logistic regression between genotypes and serum half-lives, controlling for potential confounders. Results: Among cholesterol metabolism and transport genes, expression was associated with serum PFOA for NR1H2, NPC1 and ABCG1 genes and with PFOS for NCEH1. Thyroid gene analyses are ongoing. Among all the polymorphisms in OAT genes considered, the strongest effect was the drop in PFOA was 28% steeper with a specific variant of OAT3.

Abstract Number	**O-2-23-04**
Presenter	Gregory A. Wellenius*, Rondi Butler, Scott Bartell, Tony Fletcher, Karl Kelsey
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Associations between Serum Perfluoroalkyl Acids and LINE-1 DNA Methylation in a Highly Exposed Population

Background: Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) have been associated with cardiovascular risk factors, as well as changes in gene expression and DNA methylation in animal and cellular systems. LINE-1 methylation, a measure of global DNA methylation, is also associated with cardiovascular risk factors and disease. Aims: To evaluate associations between serum perfluoroalkyl acids (PFAAs) and LINE-1 DNA methylation in a population highly exposed to PFOA. Methods: We measured serum PFAAs in a subset of adult participants in a community population highly exposed to industrial contaminants in Ohio/West Virginia at study enrollment (2005-2006) and during participation in two follow-up studies (2010-2011). Quantitative bisulfite pyrosequencing was used to measure LINE-1 DNA methylation in peripheral blood leukocytes at follow-up. Associations were expressed as predicted absolute differences in LINE-1 methylation for an interquartile shift in PFAA serum levels at enrollment and follow-up, stratified by gender. Results: Consistent with previous research, women had on average 0.47% lower LINE-1 methylation compared to men (p=<0.0001). Serum PFOA, PFNA, and PFHxS measured at enrollment were not associated with LINE-1 methylation after adjustment for covariates. Among men, an IQR difference in serum PFOA at follow-up was marginally associated with 0.09% lower LINE-1 methylation (p=0.06). In contrast, an IQR difference in serum PFOS at follow-up was associated with 0.42% and 0.31% higher LINE-1 methylation among men and women respectively (p=0.03; p=0.04). Associations with PFOS measured at enrollment were weaker (men 0.16%, p=0.02; women 0.07%, p=0.33). Conclusions: Exposure to PFOS and possibly PFOA is associated with changes in LINE-1 methylation, suggesting that these compounds may be epigenetically active. More research is needed to replicate these findings and to more precisely determine the role of epigenetics in the etiology of PFAA -related outcomes.

Abstract Number	**O-2-23-05**
Presenter	Heather Burris*, Andrea A Baccarelli, Adriana Mercado-García, Valeria Motta, Joel D. Schwartz, Katherine Svensson, Martha Maria Tellez-Rojo Solis, Robert O. Wright
Exposure	gene-environment interactions
Health domains	reproductive outcomes
Type of research	cohort study

Preterm Birth Risk Factors, DNA Methylation of the Cervix and Length of Gestation

Background: Preterm labor and cervical incompetence are responsible for ~50% of extremely preterm deliveries (<28 weeks). Mechanisms responsible for these phenomena remain poorly understood. Prostaglandins play a role in labor initiation. Whether environmental, social or host factors affect DNA methylation of the prostaglandin receptor gene 2 (PTGER2) or cervical function has not been studied. Aims: 1) Examine whether risk factors for preterm birth are associated with DNA methylation of the promoter of PTGER2 or with repetitive element DNA (long interspersed nuclear element-1 [LINE-1]) methylation. 2) Examine associations between cervical DNA methylation and length of gestation. Methods: We analyzed cervical samples from 80 pregnant participants of a prospective birth cohort study in Mexico City obtained during a concurrent Pap smear. We extracted DNA using Puregene DNA isolation kits. After bisulfite treatment, we performed DNA methylation analyses using pyrosequencing. We used linear regression models predicting DNA methylation of PTGER2 and LINE-1 adjusting for multiple independent variables. Because of the non-normal distribution of gestational age, we used accelerated failure time models to examine associations between DNA methylation and the length of gestation. Results: In adjusted models, DNA methylation of LINE-1 (% 5-methylcytosines) was associated (P <0.05) with household smoke exposure, BMI, parity, and evidence of Pap smear inflammation. DNA methylation of PTGER2 was significantly associated with Pap smear inflammation. LINE-1 DNA methylation was inversely associated with the length of gestation; per SD, gestational age was 2.3 (95%CI 0.1, 4.5) days shorter. Higher PTGER2 methylation was associated with longer gestations (1.6 days, 95%CI 0.3, 3.9). Conclusions: Household smoke exposure, BMI, parity and inflammation may be associated with DNA methylation of the cervix during pregnancy. DNA methylation of the cervix may be associated with the length of gestation.

Abstract Number	**O-2-23-06**
Presenter	Ellen Wells*
Exposure	gene-environment interactions
Health domains	ethics
Type of research	review

Privacy and other ethical considerations concerning research with susceptible populations in the digital age (e*)

Age, gender, health status, race/ethnicity and socio-economic status are attributes that may contribute to susceptibility. Concepts of susceptibility are broadening as we find molecular mechanisms conferring increased risk of disease using genomics, epigenomics, and other technologies. It is also becoming more common to consider susceptibilities in combination rather than separately. Taken together, this could potentially lead to increasingly detailed and individualized susceptibility characterization. Society at large is also becoming less private, yet more concerned about privacy. This session will (re)consider issues of privacy and susceptibility, given these current trends. We will also address the question of whether changes related to the advent of the digital age have impacted these concerns. Specific discussions could include: 1) Given the increasing amount of individual-level data now routinely collected, will the concept of susceptibility become personalized in a fashion similar to personalized medicine? Does this have the potential to impact privacy of susceptible populations? 2) Data sharing is important to continue the forward progress of research. Shared data are typically anonymous. However, it was recently reported that it is possible to identify specific individuals from their anonymized genomes. What impact does this have on the ethics of data sharing and privacy, or even data security? Given that susceptible groups often lack agency to change their environment, is there a need to take special precautions with these populations? 3) Social media are increasingly being used in research to recruit or communicate with study participants. However, social media are notorious for their lack of privacy, and are not universally accessible. Is it possible to use these tools while still protecting privacy? What steps need to be taken in order to do so? Is there a risk of exclusion of some susceptible groups using these methods?

Abstract Number	**O-2-24-01**
Presenter	Denis Sarigiannis, Spyros Karakitsios*, Alberto Gotti
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Mechanistic assessment of external and internal exposure to DEHP

Background Bis(2-ethylhexyl) phthalate (DEHP) is one of the most common phthalate plasticizers used in consumer products. Aims To develop an integrated methodological framework for assessing multi-pathway and multi-route exposure to DEHP. Methods The overall modelling framework, comprised: -Multimedia indoor air modelling, for estimating DEHP concentrations in gas, particles and dust phase starting from gaseous emissions of products containing DEHP. - Personal exposure modelling, incorporating all possible exposure pathways and routes (inhalation of DEHP, skin exposure through rubbing of dust, non-dietary oral exposure through dust ingestion). -Internal dosimetry of DEHP and its 3 major metabolites (MEHP, 5-OH MEHP and 5oxo-MEHP) in human tissues and urine through a multi-compartmental PBPK model. -Uncertainty/variability analysis across all stages of the assessment. Results In a typical residential dwelling scenario (floor area of 270 m2 and air exchange rate of 0.5 hr-1) characterized by DEHP gaseous emissions of 200 µg/h (vinyl flooring and other plastic materials), the concentrations of DEHP in the gaseous, particles and dust phase are equal to 1.5 µg/m3, 21 µg/m3 and 4400 µg/g settled dust. Overall daily intake varies between 0.2 to 10 µg/kg-bw, depending on the exposure scenarios considered, which in turn are age-dependent: adults are exposed mostly through inhalation, while infants mostly through non-dietary ingestion. For a common repeated aggregate exposure scenario of 2 µg/kg-bw, DEHP internal dose in venous blood and in adipose tissue (where a clear bioaccumulation is observed) reach a quasi-state equilibrium of 0.07 and 0.4 µg/L. Modeling results were validated against biomonitoring data from NHANES. Conclusions The expected urinary concentrations of MEHP, 5-OH MEHP and 5oxo-MEHP are 3.1, 16 and 8 µg/gCr respectively are one order of magnitude below the recommended Biomonitoring Equivalent value of 660 µg/gCr for the sum of all metabolites quantified in urine.

Abstract Number	**O-2-24-02**
Presenter	Alexi Ernstoff, Peter Fantke, Olivier Jolliet*
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure modeling

Near and far field exposure to organic contaminants through multiple parallel exposure pathways, including consumer product use, as a complement to ToxCast

Background A list of 229 concerning organic chemicals was selected by the United States Environmental Protection Agency to investigate exposure modeling to complement ToxCast high-throughput toxicology data. Chemicals often have multiple exposure pathways that must be consistently assessed. Aims We aim to identify the chemicals' parallel exposure pathways, determine population-scale exposure for each pathway, and compare their relative magnitudes. Methods Several US government databases are used to categorize chemicals into potential exposure pathways via their likely uses (e.g. personal care products, pesticides). For far field environmental exposure, we run available exposure and fate models (e.g., USEtox) to estimate intake fractions (iF) ([kg intake per kg applied per use]. Intake through pesticide residue is determined using the Dynamicrop model. Near field consumer product intake fractions characterize direct dermal intake and subsequent far field population exposures after product wash-off (e.g. cosmetics permeate the skin during use, and may contaminate drinking water after use). Results The 229 chemicals are split into 13 categories corresponding to combinations of possible exposure routes and subsequent near and far field iF. Among them, 14 are banned, 97 are agricultural and 47 are household pesticides, and 43 are in cosmetics. Many have multiple exposure pathways. For cosmetics, generally, exposure to environmental media amounts to iF ~10-6 [kg intake/ 1 daily application] versus iF ~10-1 [kg intake/ 1 daily application] through skin permeation during use. However, iF through environmental media are important if a cosmetic is mostly washed off during use, especially when the chemical partitions into drinking water and has a high bio concentration factor. Conclusions Chemical uses can be identified through existing databases and dominant exposure pathways may be estimated using available exposure and fate models. The results demonstrate the necessity of exploring parallel exposure multiple pathways to understand cumulative exposure.

Abstract Number	**O-2-24-03**
Presenter	Tatsiana Dudzina*, Natalie von Götz, Christiaan Delmaar, Jacqueline Biesterbos, Martine Bakker, Jacqueline van Engelen, Konrad Hungerbühler
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure modeling

A tiered approach to modeling aggregate consumer exposure to cyclic siloxanes

Realistic evaluation of human exposure to chemicals is essential for risk characterization and chemical safety assessment. Particularly, aggregation of consumer exposure to an individual substance from multiple sources over various routes can be challenging both for methodology and data availability. In a Tiered approach aggregate consumer exposure is calculated in a stepwise manner starting from using simple but overly conservative deterministic models (Tier1) to assimilating more accurate and complex probabilistic models (Tier2). Provided that the most important exposure pathways are included in the exposure modeling, validation of exposure assessment with biomonitoring data can help to determine which Tier is the closest to the reality and how to improve the models structure and parameterization. Aggregate consumer exposure was calculated for two cyclic siloxanes (cyclotetrasiloxane (D4) and cyclopentasiloxane (D5)) commonly used in cosmetics and personal care products (C&PCPs). For Tier2 a person-oriented probabilistic exposure model was created. The probabilistic assessment was performed for a simulated population based on individual consumers' profiles from a newly developed C&PCPs consumer habits database, thus taking into account authentic product co-use data. In Tier1 the acute total aggregate consumer exposure reached 1250 mg/kg bodyweight/day with the sun care products accounting for more than 2/3 of the dose. The chronic Tier1 exposure was four times lower. Dermal and respiratory routes equally contributed to the total internal dose. Tier2 exposure values (90th percentiles) were three orders of magnitude lower than the corresponding Tier1 results. PBPK models were used to compare Tier2 results to D4/D5 human blood plasma levels. Considering the variability and uncertainty in the PBPK model parameters a good match was observed for D4 suggesting that Tier1 approach overestimates the exposure. Comparison for D5 was difficult due to the scarcity of experimental data.

Abstract Number	**O-2-24-04**
Presenter	Shanshan Shi*, Bin Zhao
Exposure	organic compounds
Health domains	no health domain
Type of research	others

Assessment of exposure via inhalation and dermal pathways to airborne benzo[a]pyrene (BaP) of a typical residential condition in Beijing

Abstract Background: Benzo[a]pyrene (BaP) is an airborne pollutant resulting from incomplete combustions and was classified by IARC as possible carcinogenic compound to human beings. Human beings can be exposed to airborne BaP via inhalation and dermal pathways in both indoor and outdoor environment. Consequently, proper assessment of exposure to airborne BaP is very important. Aims: The aim of this study is to assess exposure of human beings to both gas- and particle-phases of BaP via inhalation and dermal pathways for both indoor and outdoor environment of a typical residential condition in Beijing. Methods: Equilibrium indoor concentrations within a typical Beijing residential home of both phases BaP were calculated. Exposure to both phases BaP via inhalation pathway can be estimated with the inhalation rate and the exposure duration. Exposure to gas-phase BaP via dermal pathway can be estimated with the skin area contact with the gas, the exposure duration and the overall skin permeability coefficient of gases. Exposure parameters based on the survey in North China were utilized in this study. Results: The total exposure is highest in winter, which is 3.08×10-3(μg/kg/d), and is lowest in summer, which is 3.27×10-4(μg/kg/d). The indoor exposure to both phases of BaP is at least 10 times higher than that of outdoor environment. The contribution of exposure to gas-phase BaP by inhalation varies from 5.94% to 6.54% and the contribution to particle-phase BaP by inhalation is between 90.59% and 92.91%. The occupancy of dermal exposure to gas-phase BaP is from 0.66% to 3.18%. Conclusions: 1) The exposure to BaP via inhalation and dermal pathways decreased with winter, spring, autumn and summer. 2) The indoor exposure to both gas and particle-phases of BaP much higher than that of outdoor environment. 3) The exposure to particle-phase BaP by inhalation is the most important exposure pathway, followed by which is the exposure to gas-phase BaP by inhalation. The exposure to gas-phase BaP via dermal pathway is the least important.

Abstract Number	**O-2-24-05**
Presenter	Jolliet Olivier*, Cedric Wannaz, Joe Lane
Exposure	organic compounds
Health domains	respiratory disease
Type of research	exposure modeling

Why is multiscale exposure modeling essential to determine the burden of disease of pollution in Australia

Background Spatialized emission inventory are available for close to 300 point sources and 100 substances in Australia. To use these data to prioritize possible actions, it is essential to understand the spatial distribution of intakes and health impacts. Aims We aim a) to parameterize Pangea - a multiscale model of fate and exposure that determines spatially distribute exposures, and b) to apply the model to analyze population intakes for emission sources across Australia. Methods We first build multi-scale multi-media grids refined around each source and high population density area. Concentrations and multi-pathways exposures are calculated for test substances. We then analyze overall intakes as well as intake fractions for four source-to-receptor patterns: outback Alice Springs, suburban Sydney, Sydney and an offshore platform NW from Australia. Results Depending on source location, cumulated intake fractions of benzene vary from 2ppm in Alice Springs to 23 ppm at Sydney airport. For Alice Springs, 10% of the intake is local, 20% is at 2300 km - Sydney and Melbourne, the rest at more than 3000 km, in particular in highly populated Indonesia which is under dominant wind direction. For an emission 150km West of Sydney, 70% of the 5ppm taken in occur in Sydney. This proportion rises to 90% for emission at Sydney airport. The offshore platform has most of its impact in Indonesia. In contrast, benzo[a]pyrene impacts are primarily associated to deposition on local fields and subsequent bioconcentration in food, with highest impacts in regions of high agriculture production intensity. Maps of resulting concentrations, intake and burden of disease will be presented. Conclusions The multiscale approach models accurately spatial distribution of intake fraction while limiting calculation time. Prioritization schemes for intervention need to consider both emission sources and exposed receptors to take full advantage of spatialized emission inventories.

Abstract Number	**O-2-24-06**
Presenter	Emiko Todaka*, Masahiro Watanabe, Yoshiharu Matsuno, Masamichi Hanazato, Hiroko Nakaoka, Chisato Mori
Exposure	persistent organic pollutants
Health domains	other
Type of research	cohort study

Relationship between food intake & geographic information from questionnaire and blood PCB level in birth cohort study

Background: Our previous studies indicated that blood PCB (polychlorinated biphenyl) level was affected by factors regarding age and past delivery experience. In Japan Environment and Children's Study (JECS, a Japanese national birth cohort study), a detail questionnaire survey regarding food intake and geographic (residences' address) information has been conducted. Aims: The aim of this study was to examine the relationship between maternal blood PCB level and sea food intake/geographic information from the JECS's questionnaires. Methods: We measured the serum total PCB from pregnant women in Chiba Prefecture, who participated in the JECS in 2012. The number of the subjects was 352 (age: 17-43). Total PCB was analyzed from serum by using a gas chromatograph equipped with a packed column and electron capture detector (Packed column GC/ECD). Using Spearman's rank correlation coefficient, Fisher's exact test and Geographic Information System (GIS), we examined the relationship between maternal blood PCB level and sea food intake/geographic information. Results: PCB was detected from 95% of nulliparous (average was 0.30 ± 0.14 ng/g-wet) and 90% of multiparas (average was 0.26 ± 0.12 ng/g-wet). The blood PCB level increased with age. We found strong association ($P<0.01$) between blood PCB level and intake of bonito, yellowtail, saury, cod roe and tuna. Comparing the blood PCB levels between coastal area and other areas, a tendency was found that the PCB level in the region where many fishermen live in coastal area was higher than other areas. Conclusion: Our present study indicated the possibility that sea food intake and geographic information in the questionnaire can sample the high exposure group to PCB and POPs. The answers to the questionnaires can be used to detect potential high risk group in a cost and time effective manner in a large scale cohort study. (The current data of JECS is not the final data but tentative and limited data of Chiba Prefecture)

Abstract Number	**O-2-25-01**
Presenter	David Hondula*, Robert Davis, Michael Saha
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

The predictability of high-risk zones for heat-related mortality within seven U.S. cities

Background: Within major metropolitan areas there is spatial variability in heat-related mortality, but it is not known whether the places associated with high mortality are consistent across time. Temporal changes in geographic patterns of heat risk would have important implications for intervention strategies and projections of health outcomes in future climates. Aims: We sought to quantify the predictability and temporal variability of high-risk zones for heat-related mortality in seven climatically diverse cities in the United States. Our hypothesis is that high-risk zones can be reliably predicted from historical data. Methods: 25 years of daily postal code-level counts of mortality data were split into training and testing data sets. A two-stage modelling approach was used to identify zones within each city with significantly high mortality during the training period. These zones were labelled as hypothetical "targets" for intervention activities. We then evaluated model skill in predicting high-risk zones in advance. We also used cross-validation to quantify the overall temporal variability irrespective of chronological sequence. Confounding variables including seasonality and long-term trends were accounted for with a generalized additive model. The study was limited to days that were associated with both high temperatures and high mortality rates at the city-wide scale. Results: Heat-related mortality in the testing period was found to be significantly higher in target zones compared to non-target zones. Target zones were also more likely to be high mortality zones in the testing period than non-target zones. In most cities the number of zones of high heat-related mortality declined from the training to the testing period. Conclusions: Geographically-targeted long-term intervention measures aimed at reducing the public health burden associated with heat stress may be effective because the location of high-risk zones is relatively consistent over time.

Abstract Number	**O-2-25-02**
Presenter	Jaime Madrigano*, Kazuhiko Ito, Patrick Kinney, Thomas Matte
Exposure	climate change (temperature)
Health domains	other
Type of research	others

Vulnerability to Extreme Heat in New York City

Background: Exposure to high ambient temperature and extreme heat is increasingly recognized as an important environmental health hazard. Understanding which populations are most vulnerable is informative for public health preparedness. Aims: To determine what characteristics increase susceptibility to mortality on days of high temperature and extreme heat and examine how these susceptibility factors have changed over time. Methods: We performed a case-only analysis of mortality records (from non-external causes) in New York City (NYC) during the period 1978 – 2009. After restricting to warm months (May – September), there were a total of 754,185 cases. We stratified our analysis into three approximately equal time periods. Temperature was assessed in two ways: using a linear term for same-day mean temperature and using an indicator for same-day extreme temperature. An extreme hot day was defined as any day when the daily minimum temperature was at its 99th percentile or greater during that time period. Results: During the period 1999-2009, compared to other warm season days, deaths on extremely hot days were more likely from cardiovascular disease (CVD) (odds ratio (OR) = 1.10, 95% confidence interval (CI), 1.02 – 1.17) and more likely to occur at home (OR = 1.24, 95% CI, 1.12 – 1.38). The excess of deaths at home on hot days was seen in all time periods. The proportion of deaths that were among those 85 years and older was increased during the periods 1978-88 and 1989-99 (OR = 1.10, 95% CI, 1.02 – 1.18), but not in the most recent time period. Conclusions: Our findings suggest greater susceptibility to heat related mortality among those with cardiovascular disease. The association of at home deaths with extreme heat could reflect heat exposure at home, social isolation, or some combination of these factors. Further analyses will examine spatial and additional demographic risk factors to help target interventions at the most vulnerable.

Abstract Number	**O-2-25-03**
Presenter	Geoffrey Nwaka*
Exposure	others
Health domains	other
Type of research	others

Indigenous Knowledge as Local Response to Climate Change in Nigeria/Africa

Africa contributes least to but suffers most from the disastrous consequences of climate change. The industrialized and more affluent countries are rightly expected to take greater responsibility for the current environmental and economic crises, but Marshall Sahlins has emphasized the need for all peoples “to indigenize the forces of global modernity, and turn them to their own ends”, as the real impact of globalization depends largely on the responses developed at the local level. How can Africa engage profitably with globalization, and cope effectively with the worsening threats of flooding, droughts and other emergencies that result from extreme weather conditions? This paper considers how indigenous knowledge and practice can be put to good use in support of agriculture and natural resource management, poverty alleviation, and the mitigation and adaptation to climate change. Although poverty may sometimes force people to use resources unsustainably, most traditional African societies believe that land and other forms of nature are sacred, and are held in trust by the present day users on behalf of dead ancestors and future generations. The indigenous knowledge movement has great potential for the mitigation and adaptation to climate change. Africa cannot now resort to an insular and entirely home grown approach to its development, but indigenous knowledge offers a model for rethinking and redirecting the development process. Development agents, researchers and donors, who often assume a knowledge or capacity vacuum in Africa, should instead try to tap into indigenous knowledge about locally appropriate ways of forecasting weather systems, traditional techniques of soil management, pest and disease control, adopting suitable crop and animal varieties, and so on. By building on the indigenous we can make development more participatory and sustainable, and also promote intercultural dialogue in African development.

Abstract Number	**O-2-25-04**
Presenter	Alana Hansen*, Peng Bi, Arthur Saniotis, Monika Nitschke, Jill Benson, Val Smyth, Leigh Wilson, Gil-Soo Han, Yan Tan, Lillian Mwanri
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	others

The adaptive capacity of migrants to climate change in Australia

Background: In Australia, increasing immigration has contributed to a highly multicultural society where more than 25% of the population were born overseas. In accordance with projections, record-breaking extreme weather events are becoming commonplace, causing concern for public health. However, it is unknown if migrants to Australia will be disproportionately impacted by climate change. Aims: To ascertain the vulnerability to climate change of culturally and linguistically diverse (CALD) communities in Australia and seek recommendations to build the adaptive capacity of new migrants. Methods: Interviews and focus groups were conducted with stakeholders from the government sector, non-government organisations, the health sector and CALD communities in three capital cities in Australia. Data were analysed using thematic analysis. Results: Stakeholders perceived that migrants generally have high adaptive capacity in their adopted country. However, adaptation to climate change may be hindered by lack of acclimatisation, socio-economic constraints and an inability to access English-only emergency messages. Information about low cost adaptive strategies needs to be provided to new migrants on arrival in Australia, during heat emergencies and via community education programs. Promoting social connectedness will also better enable coordinated community action and a whole of population approach to climate change adaptation. Conclusion: A suite of communication tools to build resilience to climate extremes is needed for all residents including people with diverse cultural, linguistic and religious backgrounds. Stakeholders generally perceived that given equal opportunity and access to information, migrants would be no more impacted by climate change than others in the population.

Abstract Number	**O-2-25-05**
Presenter	Mathilde Pascal*
Exposure	climate change (temperature)
Health domains	ethics
Type of research	review

From epidemiology to adaptation to climate change (e*)

Studies of the health impacts of climate change have been largely used to advocate for mitigation. Epidemiologists should also contribute to adaptation, i.e. initiatives to reduce the vulnerability of the human enterprise against actual or expected consequences of more frequent and extreme weather events. They should also ensure that adaptation and mitigation strategies implemented by various sectors will not cause adverse health effects. Climate change adds to other pressures, such as population growth, urbanization and food security, and contributes to territorial imbalances. It deeply influences the natural, but also the human socio-cultural environment. Studying the health effects of climate change is a complex issue, and to contribute efficiently to adaptation, epidemiologists have to frame it in simple, but not simplistic, questions. To orientate adaptation, one cannot work on the climate/weather/health relationship only. The foreseen changes in risk/exposure, individual sensitivity, and the capacity for adaptation, are three factors contributing to overall vulnerability and these must be investigated. Epidemiology alone cannot tackle all these aspects, and there is an ethical duty for epidemiologists to be aware of its limits. Working on adaptation requires a broadening of the fields of environmental epidemiology, linking with other disciplines, especially the environmental and social sciences. Studies should be designed in collaboration with community stakeholders, and the results must be widely disseminated. The discussion aims to provide an opportunity for the audience to identify the ethical dimensions of their studies in the perspective of adaptation.

Abstract Number	**O-2-25-06**
Presenter	Manuela De Sario*, Anna Maria Bargagli, Damia Noce, Claudia Marino, Simona Vecchi, Paola Michelozzi
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Temporal variations in the impact of a local surveillance program to prevent heat wave-related effects on elderly population in Rome, Italy

Background and aim: Since 2006, a surveillance program to reduce the effect of heat waves (HW) has been operating in Lazio Region. According to regional guidelines, General Practitioners (GPs) are asked to monitor more susceptible elderly patients, in particular through home visits when HW are predicted by the warning system of Rome. Six years apart the activation of the program, our aim was to describe the temporal change in the characteristics of susceptible elderly and their mortality risk during HW in Rome. Methods: We retrieved socio-demographic data and previous hospital admissions as a proxy of prevalence of chronic diseases for 65+ yrs residents for the period 2007-2012. All-cause mortality was obtained from the Municipal Mortality Registry. A Poisson regression model was applied to estimate the Relative Risk (RR) of dying during HW days among surveilled patients, by age group. Results: Out of 601177 elderly, the surveilled were about 1.8% (mean 2007-2012). In the first years of program implementation, a greater proportion of surveilled was 75+ yrs old (82% in 2007 vs 73% in 2012) while in the last years the proportion of 65-74 age group increase. Among surveilled, the prevalence of chronic diseases decreased over time. In 2007 and 2008, the program seems to protect the oldest surveilled patients during HW; conversely, in the last years, surveilled were more at risk, especially those aged 65-74 yrs, in particular during summer 2010 HW (RR= 2.05 95%CI 0.91-4.65). Conclusions: Results from this study suggest that despite the 65-74 yrs represent an increasing proportion of susceptible population, GPs still tend to give more attention to very old patients and in the last years surveillance activity does not seem to protect the youngest age group. Considered the amount of resources allocated, local decision makers are urged to evaluate the appropriateness of GPs surveillance but also the adherence to regional guidelines.

Abstract Number	**O-2-26-01**
Presenter	Donguk Park*, Kyungmin Lee, Seung-hun Ryu
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Size characteristics of particulate matters generated during municipal household waste handling activities

Background: Few studies have been conducted to assess particulate matter (PM) level generated during municipal waste handling work. Aims: This study was conducted to assess size characteristics of particulate matter(PM) generated during waste collection and sorting and to identify occupational and environmental factors affecting PM10 and PM2.5 level. Methods: A Portable Aerosol Spectrometer (Model 1108, Grimm, Germany) calibrated to 1.2 L/min was used to monitor PM generated during waste collection and handling activities. The aerosol level includes inhalable particulate matter (IPM), thoracic (TPM), respirable particle (RPM), PM10 and PM2.5 and PM1.0. A total of 28 set PM records monitored were categorized according to occupation and environmental classifications including type of waste handling activity, city and time serviced, weather, season. Analysis of variance (ANOVA) was used to compare PM levels among environmental and occupation categories characterized by size. Significant variables with p-value <0.25 were finally introduced to multiple regression model for predicting PM10 and PM2.5, respectively. Results: The average levels of PM10 and PM2.5 were much higher than air quality levels enforced by Korea EPA. Both the “type of waste-handling activity” and "season" were the only factor that significantly affected PM10 and PM2.5 levels, accounting for 38% ($p = 0.029$) and 50% ($p = 0.0002$) of the observed variation, respectively. Conclusions: PM10 and PM2.5 levels were found to be high during waste collection activity. The highest PM2.5 level with fine particles was monitored during waste transfer work, while the highest PM10 level with coarse particles was monitored during waste sorting work.

Abstract Number	**O-2-26-02**
Presenter	M. Patricia Fabian*, Susan A. Korrick, Junenette Peters, Jonathan Levy
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	exposure modeling

Modeling population exposure to multiple chemical and non-chemical stressors in a low income community near a hazardous waste site

Background. ADHD-related behavior is associated with multiple risk factors, including sociodemographic characteristics and exposures to heavy metals and organochlorines. Determining the cumulative impacts of these factors on ADHD-related behavior across a community involves building exposure models that integrate spatial and demographic patterns of multiple stressors. Aim. Develop models of chemical and non-chemical risk factors associated with ADHD-like behavior, and use them to identify high-risk subpopulations. Methods.Using data from an established birth cohort in New Bedford (NB), Massachusetts, we developed regression models to explain variability in exposures to prenatal and postnatal chemical (e.g., lead (Pb), mercury (Hg), and organochlorines (DDE and PCB)) and non-chemical (e.g., maternal stress) stressors associated with ADHD-like behavior. We applied the models to a synthetic database of all NB residents generated by combining microdata from the American Community Survey with census tract-level individual and household variables. The resulting individual-level exposure estimates were aggregated by census tract and used to evaluate spatial and demographic patterns. Results. We identified census tracts at high risk of exposure to prenatal Pb, PCB, DDE and Hg, postnatal Pb, and multiple non-chemical stressors. Variability in exposure was better predicted by spatial distributions of predictive socioeconomic, housing, and food consumption factors rather than spatial patterns of ambient pollutant exposure, although few children lived close to potential point sources. In the case of PCBs, high exposure was related to patterns of fish and organ meat consumption, age, and mother's country of birth, but not to proximity to a PCB-contaminated hazardous waste site. Conclusions. We identified subpopulations at high risk of exposures to both chemical and non-chemical exposures associated with ADHD-like behavior in a low income community.

Abstract Number	**O-2-26-04**
Presenter	Aimin Chen*, Xijin Xu, Xiangbin Zheng, Stephani Kim, Yuling Zhang, Taofeek Yekeen, Tiina Reponen, Kim Dietrich, Shuk-mei Ho, Xia Huo
Exposure	waste
Health domains	reproductive outcomes
Type of research	cohort study

Neonatal physical measurement in relation to electronic waste recycling exposure in the community

Background: Electronic waste (e-waste) recycling practices in developing countries are usually not regulated and involve using primitive technology with little to no environmental and occupational protection. Adverse developmental effects of environmental exposure to toxicants in e-waste recycling are suggestive but large epidemiologic studies are needed to examine detailed fetal growth pattern. Methods: We enrolled 920 pregnant women (603 from an e-waste recycling community and 317 from a non-recycling control community 20 km away) in Shantou, China and examined birth outcomes: gestational age (GA), birth weight, birth length, head circumference, body mass index (BMI), and Ponderal Index (PI). We analyzed physical growth indicator differences between sites by adjusting for maternal age, parity, education, occupation, environmental tobacco exposure, permanent residence status, maternal BMI or length (for birth length), newborn sex, and GA (for non-GA outcomes). Results: Compared with neonates from the control site, neonates from the recycling community had slightly longer gestational length (mean 39.9 vs. 39.4 weeks, adjusted β 0.5 [95% confidence interval 0.3-0.7]), longer body length (mean 51.6 vs. 50.4 cm, β 1.2 [0.8-1.5]), but smaller weight (mean 3222 vs. 3265 g, β -50 [-140, 40]), smaller head circumference (mean 33.9 vs. 35.3 cm, β -0.9 [-1.3, -0.5]), smaller BMI (mean 12.1 vs. 12.9 kg/m2, β -0.8 [-1.1, -0.5]), and smaller PI (mean 23.5 vs. 25.5 kg/m3, β -2.1 [-2.7, -1.5]). Conclusion: Exposure to e-waste recycling in the community is related to reduced weight and head growth but not length or gestational age in fetuses.

Abstract Number	**O-2-26-05**
Presenter	Martina Nicole Golini, Carla Ancona*, Andrea Bolignano, Simone Bucci, Marina Davoli, Francesca Mataloni, Silvia Narduzzi, Roberto Sozzi, Francesco Forastiere
Exposure	waste
Health domains	respiratory disease
Type of research	cohort study

Morbidity in a population living close to urban waste incinerators: a retrospective cohort study using air dispersion models and a before-after design

Background Knowledge of health effects of residential exposure to urban waste incinerators mainly derives from ecological studies with limited exposure assessment. Aims We evaluated the impact of two incinerators (first active in January 2003) on cardiovascular and respiratory hospital admissions in a cohort of people living nearby during the period 1996-2008. Methods The study area was defined as the 7 km radius around the incinerators. SPRAY Lagrangian dispersion model for PM10 was used for incinerators exposure assessment (three zones: PM10<3.40, 3.40-3.93, >3.93 ng/m3). People who were residents in 1/1/1996, or subsequently became residents up to 31/12/2008, were enrolled in a longitudinal cohort study with a before-after evaluation. All subjects were followed for hospital admissions in the period pre (1996-2002) and after (2003-2008) the activation of the plants. The association between residence in the three zones and hospitalizations in the two periods was estimated using multivariate Cox model (for repeated events) adjusting for sex, age, area-level SES, distance from industries and traffic roads, and background levels of PM10. An interaction term between the period of the follow-up (before-after) and the exposure levels was used to test the effects of the incinerators. Results We enrolled 47,192 residents between 1996 and 2008; the majority of the cohort members were still resident in the period post plants activation (50.4% of whom exposed to low, 20.3% to high PM10 concentration). We found an association between PM10 high concentrations and cardiovascular, respiratory and COPD hospitalization (HR 1.08; 95CI% 0.94-1.25, HR 1.14; 0.96-1.37, and HR 1.56; 0.96-2.54, respectively). The association was stronger when considering only men for cardiovascular diseases (HR 1.24; 0.97-1.60), respiratory diseases (HR 1.26; 0.99-1.60) and COPD (HR 1.86; 1.04-3.33). Conclusions Living in areas with higher PM10 levels due to incinerators was associated with increased morbidity levels for cardiovascular and respiratory disorders.

Abstract Number	**O-2-26-06**
Presenter	Xia Huo*, Xijin Xu, Yinmei Chiung
Exposure	waste
Health domains	other
Type of research	health impact assessment

Co-exposure to Biphenyl A, Polychlorinated Biphenyls and Cadmium in Utero on fetus development

Background: Polychlorinated biphenyls (PCBs), biphenyl-A (BPA) and cadmium (Cd) exposures in utero increase the risk of development. In this study, we investigated the possible synergic effects and potential mechanism of these chemicals in an e-waste exposure area, Guiyu. Methods: We enrolled 216 pregnant women, 153 from Guiyu as the exposed group and 47 from other area as control groups, who voluntarily donated cord blood and placenta after birth. The contents of PCBs, BPA in cord blood, and Cd and lead in placenta tissue were measured by GC-MS and GFAAS, respectively. The gene expression of KiSS-1 in UCB and leptin, leptin receptor in placenta were detected by real time RT-PCR. Results: The cord blood BPA concentration in Guiyu was significantly higher than that in control. Total PCB concentrations were also significantly higher in cord blood from Guiyu than control. The mean value of placental Cd in exposed group was significantly higher than that in control group. All of the relative gene expressions of KiSS-1, leptin and its receptors in Guiyu were significantly higher than that in the control. In addition, a positive association had been found between BPA concentration and expression of KiSS-1 and such association in male neonates was more significant. The placental cadmium level were positively related with the expression of leptin and leptin receptor in placenta, and the expression of leptin and leptin receptor were positively related with birth weight and birth height, separate by gender, the higher association in female neonates was observed. Conclusion: Neonates in Guiyu had higher inner exposure to BPA, PCBs and Cd, that possibly stimulate the expression of gene of KiSS-1, leptin and leptin receptor.

Abstract Number	**O-2-28-01**
Presenter	Antonio Gasparrini*, Michela Leone, Aurelio Tobias, Ben Armstrong
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	time series study

Temporal variation in temperature-health associations: a multi-country study

Background: a key issue in the assessment of temperature-health associations is to determine if and how the effects vary in time, a subject which has been rarely evaluated. Aims: to investigate the issue with an analysis of data from multiple countries experiencing different climates, using novel statistical approaches. Methods: a two-stage time series analysis is performed on mortality data in summer months (June-Sept) from 108 cities in USA (1987-2000), 52 cities in Spain (1990-2004) and 15 cities in UK (1993-2006). City-specific models include bi-dimensional splines of temperature with a distributed lag non-linear parameterization on lag 0-10 and interaction terms with time. Estimates are reduced to overall cumulative and predictor-specific summaries, and pooled with country-specific multivariate random-effects meta-analyses. Results: some evidence of temporal trend exists in USA, with a decrease in risk associated with heat. The overall average relative risk at 99th vs 50th summer temperature centile is predicted as 1.12 (95%CI: 1.08-1.17) in 1987 vs 1.07 (1.04-1.10) in 2000. In addition, the lag period with positive risks decreases from 0-6 to 0-2 days. The association is higher but stable in Spain, with corresponding estimates of 1.48 (1.38-1.60) in 1990 vs 1.43 (1.37-1.50) in 2004, over lag 0-8 throughout. The risk is lower but increases over the period considered in UK, with estimates of 1.05 (0.97-1.15) in 1993 vs 1.21 (1.13-1.29) in 2006, limited to lag 0-2. There is no evidence of harvesting in any country. Discussion: temporal variation in susceptibility to heat likely depends, amongst other factors, on climatological and demographic characteristics, behavioural aspects such as air conditioning use, and on implementation of policy interventions. These results can be useful for better characterizing the association and informing prediction models for temperature-related impact of climate change.

Abstract Number	**O-2-28-02**
Presenter	Brooke Anderson*, Francesca Dominici, Yun Wang, Meredith McCormack, Michelle L. Bell, Roger Peng
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	time series study

Heat-related emergency hospitalizations for respiratory diseases in the Medicare population

Background: The heat-related risk of hospitalization for respiratory diseases among the elderly has not been quantified in the United States on a national scale. With climate change predictions of more frequent and more intense heat waves, it is of paramount importance to quantify the health risks related to heat, especially for the most vulnerable. Aims: To estimate the risk of hospitalization for respiratory diseases associated with outdoor heat in the US elderly. Methods: We obtained daily county-level rates of Medicare emergency respiratory hospitalizations (ICD-9 464–466, 480–487, 490–492) of ~12.5 million Medicare beneficiaries in 213 United States counties for 1999-2008. We estimated a national average relative risk of hospitalization for each 10oF (5.6oC) increase in daily outdoor temperature using Bayesian hierarchical models. Results: Overall, each 10oF increase in daily temperature was associated with a 4.3% increase in same-day emergency hospitalizations for respiratory diseases (95% posterior interval: 3.8, 4.8%). Counties' relative risks were significantly higher in counties with cooler average summer temperatures. Conclusions: We found strong evidence of an association between outdoor heat and respiratory hospitalizations in the largest population of elderly studied to date. Given projections of increasing temperatures from climate change and the increasing global prevalence of chronic pulmonary disease, the relationship between heat and respiratory morbidity is a growing concern.

Abstract Number	**O-2-28-03**
Presenter	Magali Hurtado-Díaz*, Luis A. Arias-Medellín, Horacio Riojas Rodríguez, Grea L. Moreno-Banda, José Guzmán-Ontiveros
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Temperature effects on scorpion sting incidence in an endemic region of Mexico: a regional analysis.

BACKGROUND and AIMS The scorpion sting poisoning is a major cause of hospitalization in several countries and Mexico is not the exception. Although the number of cases has decreased, morbidity remains high in some states, including Morelos, which is one of three states with the highest incidence of scorpion stings in Mexico. Therefore, this study aims to explore the impacts of climate changes on the incidence of scorpion sting in different climatic regions of Morelos, Mexico. METHODS An ecological study was conducted using a retrospective time series analysis of precipitation and minimum and maximum temperatures from 23 meteorological stations as well as weekly cases of scorpion stings reported by the Unique System of Information for Epidemiological Surveillance (SUIVE) during 1999-2007. The state was divided into three climatic regions (semi-cold, semi-warm and warm), and a group of municipalities was assigned to each region according to the present climate. Relative risks (RR) of scorpion sting cases for an increase of 1°C of temperature were calculated for each climatic region to provide a regional analysis. RESULTS During the period studied a total of 281,076 cases were reported with an average rate of 1,757 per 100,000 inhabitants. Significant associations were found between scorpion sting cases and the minimum and maximum temperatures. Relative risk (RR) for scorpion sting cases ranged from 1.072 (95% confidence interval [CI, 1.071 to 1.074) for minimum temperature to 1.093 (95% CI, 1.091 to 1.095) for maximum temperature in the warm region; from 1.107 (95% CI, 1.104 to 1.110) for minimum temperature to 1.070 (95% CI, 1.067 to 1.072) for maximum temperature in the semi-warm region; and from 1.178 (95% CI, 1.066 to 1.303) for minimum temperature to 0.092 (95% CI, 0.814 to 1.049) for maximum temperature in the cold region. CONCLUSIONS The scorpionism is still a public health problem in endemic areas of Mexico and is associated with minimum and maximum temperature in different climatic regions.

Abstract Number	**O-2-28-04**
Presenter	Jiajia Wang*, Gail Williams, Weiwei Yu, Xiaochuan Pan, Shilu Tong
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	case-crossover study

Exposure to a heatwave during pregnancy and stillbirth: A case-crossover study

Background:Many studies have explored the impacts of heatwave on mortality and morbidity. However, no studies have examined the relationship between exposure to a heatwave during pregnancy and stillbirth. Aims: To investigate the short-term effects of heatwave on stillbirth. Methods: We obtained the daily data on stillbirths, sociodemographic factors, air pollutants and meteorological factors for Brisbane, Australia, during 2000-2010 from relevant government agencies. Three heatwave definitions (i.e., daily maximum temperature exceeded the 90th percentile (30.38°C) for 2, 3 or 4 consecutive days) were used in this study. For each case of stillbirth, four control periods before or after each case period in the same month were used. A time-stratified case-crossover analysis was conducted to examine the relationship between exposure to a heatwave during pregnancy and stillbirth. Results: A rising trend was found with the odds ratios of stillbirth increased from 1.14 (95% confidence interval (CI): 0.90-1.45) to 1.18 (95%CI: 0.87-1.59) when the durations of heatwave increased from 2 to 4 days. In sensitivity analysis, similar results were observed when a different definition of heatwave was used (i.e., daily maximum temperature exceeded the 95th percentile (31.32°C) for 2, 3 or 4 consecutive days). Conclusions: There was a non-significant increase of odds ratio for stillbirth during heatwaves. More large population-based studies should be conducted to better understand the impacts of heatwave on stillbirth.

Abstract Number	**O-2-28-05**
Presenter	Liqun Liu*, Xiaochuan Pan, Yakufu Aimaier, Jiajia Wang
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	time series study

Adverse reproductive outcomes and outdoor air temperature in Haidian District, Beijing

Background Adverse reproductive outcomes have been described as having seasonality caused by maternal exposure to outdoor air temperature during pregnancy. However, the direction of the temperature effect and the critical exposure time windows are unclear. Aims We investigated the effect of temperature on preterm birth (PTB) and birth defect (BD) in Haidian district, Beijing. The concerned exposure time windows for PTB and BD were the last trimester of pregnancy and the first trimester of plus one month before pregnancy, respectively. Methods We estimated the nonlinear and delayed effects of temperature within each month (meaning the 1st, 2nd and 3rd month before birth or after pregnancy, and the month before pregnancy) by distributed lag nonlinear models using Logistic time-series regression including potential confounders. We calculated the odd ratios (OR) of PTB or BD in association with each monthly average temperature. Results An elevated temperature on a day within all the three months before birth would announce its effect on PTB after 0-2 and 8-18 days. A declined temperature on a day within the 1st, 2nd or 3rd month before birth would announce its effect on PTB after 2-9 and 21-26 days, 4-12 and 22-26 days or 0-3 and 11-22 days, respectively. A declined temperature on a day within the month before or the 3rd month after pregnancy would lead to BD after 1-12 and 24-27 days; a declined temperature on a day within the 1st or 2nd month after pregnancy would lead to BD immediately after 0-1 day. The most noticeable OR of PTB was 1.18 (0.78, 1.78) with a 5℃ increase in average temperature of the 1st month before birth, of BD was 0.51 (0.19, 1.38) with a 5℃ increase in average temperature of the 3rd month after pregnancy. Conclusions Both high and low temperature in the last trimester of pregnancy led to preterm birth. Only low temperature in the first trimester of pregnancy and the month before pregnancy led to birth defect.

Abstract Number	**O-2-30-01**
Presenter	Maya Negev*
Exposure	no exposure
Health domains	policy
Type of research	others

Environmental Health Policy: Inter-Ministerial Aspects

Background: Environmental health (EH) is an interagency issue, determined by multiple governmental agencies, often requiring collaboration between them. This entails barriers for advancing EH governance, e.g. conflicting priorities & interests, different disciplinary backgrounds. Aims: map interagency dynamics regarding EH policy in Israel comparing to other countries. Identify the policy implications of different collaboration modes. Methods: Qualitative analysis of official documents, 37 interviews & 11 international phone consultations, using case studies of pesticides regulation & implementation of Clean Air Act in Israel. Results: Interagency EH governance differs across countries. For example, on the level of division of regulations, EH regulation in the US is under the environmental agency. The health agency designs EH policy directed at the health system & public. In Israel, Ministry of Agriculture regulates pesticides, while air pollution regulation was recently transferred to the Ministry of Environmental Protection. On the Interagency collaboration level, around 50 different mechanisms were identified (inter-ministerial committees, joint research, data integration etc.) & their policy implications analyzed. E.g., the Israeli inter-ministerial pesticides committee enables collaboration & builds trust. Yet existing working procedures & power relations are hard to change & important issues are neglected/ delayed. Conclusions: In Israel, Ministries have a variety of relationships & collaboration mechanisms regarding EH governance. These enable inter-ministerial collaboration regarding significant EH aspects, but not others. Advanced collaboration mechanisms in the world can be relevant to Israel. In the context of joint governance, more attention should be paid to the balance between governing bodies regarding agenda-setting, regulation & implementation & to inter-disciplinary capacities. The next stage of this research will develop a policy package for addressing this challenge.

Abstract Number	**O-2-30-02**
Presenter	Matti Jantunen*, Arja Asikainen, Marjo Niittynen, Erkki Pärjälä, Jouni T. Tuomisto
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Conceptual model linking urban GHG policies to health and wellbeing [URGENCHE]

Background: Urban policies, planning, development and life influence most of the greehouse gas (GHG) emissions arising from heat and power generation, industry, buildings and transport. Different GHG policies which have similar GHG impacts may at the same time have very different, even opposing impacts on public health and wellbeing. Objectives: The URGENCHE project objectives are (i) specific, to develop for the cities of Basel, Kuopio, Rotterdam, Thessaloniki and Stuttgart in Europe, Suzhou and Xi'an in China realistic greenhouse gas reduction policy packages which maximize the net health and wellbeing cobenefits and (ii) general, to develop broadly applicable and flexible modeling platform for urban GHG policy – health and wellbeing assessment. Methods: The conceptual model presented here, is a tier 1 tool. Its spatial scale is one urban area. It links with linear models GHG policy induced changes in urban structure, heat and power demand and generation, housing, buildings and transport/commuting to respective changes in overall GHG emissions, public health and wellbeing. Its platform is a quantitative description of the current state (input quantities and relations to output quantities) in a particular city and the policies are implemented as either gradual annual relative changes (e.g., new housing) or instantaneous step changes (e.g., new metro line) in the input parameters. The policy impacts are modeled into the future year by year. Results: The result is a modeling platform which is in principle adaptable for any city for which sufficient data describing the current state is available or can be estimated and for which the impacts of the complementary and alternative GHG policies on the input parameters can be formulated. Conclusions: The model is relatively simple and comprehensible. The major challenges relate to adapting differently formatted and detailed input data from different cities into one common platform. Acknowledgement: URGENCHE is funded by EU FP7 contract no 265114

Abstract Number	**O-2-30-03**
Presenter	Carolina Espina*, Miquel Porta, Joachim Schüz, Ildefonso Hernández Aguado, Robert V. Percival, Carlos Dora, Terry Slevin, Julietta Rodriguez Guzman, Tim Meredith, Philip J Landrigan, Maria Neira
Exposure	others
Health domains	cancer
Type of research	review

Environmental and Occupational Interventions for Primary Prevention of Cancer: A Cross-Sectorial Policy Framework

Background: Nearly 13 million new cancer cases and 7.6 million cancer deaths occur worldwide each year; 63% of cancer deaths occur in low and middle-income countries. A substantial proportion of all cancers are attributable to carcinogenic exposures in the environment and the workplace. Objective: To develop an evidence-based global vision and strategy for the primary prevention of environmental and occupational cancer. Methods: We identified relevant studies through PubMed by use of combinations of the search terms "environmental", "occupational", "exposure", "cancer", "primary prevention" and "interventions". To supplement the literature review, we convened an international conference on "Environmental and Occupational Determinants of Cancer: Interventions for Primary Prevention", under the auspices of the World Health Organization, in Asturias, Spain on 17-18 March 2011. Discussion: Many cancers of environmental and occupational origin could be prevented. Prevention is most effectively achieved through primary prevention policies that reduce or eliminate involuntary exposures to proven and probable carcinogens. Such strategies can be implemented in a straightforward and cost-effective way based on current knowledge. They have the added benefit of synergistically reducing risks for other noncommunicable diseases by reducing exposures to shared risk factors. Conclusions: Opportunities exist to revitalize comprehensive global cancer control policies by incorporating primary interventions against environmental and occupational carcinogens.

Abstract Number	**O-2-30-04**
Presenter	Sericea Stallings-Smith, Ariana Zeka*, Patrick G. Goodman, Zubair Kabir, Luke Clancy
Exposure	others
Health domains	policy
Type of research	time series study

Socioeconomic Differentials in the Immediate Mortality Effects of the National Irish Smoking Ban

Background: Following implementation of the national Irish smoking ban on March 29, 2004, immediate reductions were observed in smoking-related mortality. Aims: The purpose of this study was to examine these mortality effects by area-level socioeconomic status (SES). Methods: Irish census data for the years 2002 and 2006, with linear interpolation determining remaining values for 2000-2007, were used to generate four county-level, SES indices for unemployment, household crowding, education, and occupation. Indices were assigned to 215,878 non-trauma deaths in ages ≥35 years. Poisson regression with interrupted time-series analysis was conducted to examine age and gender-standardized rates for cause-specific weekly mortality, stratified by tertiles of each SES index. All models were adjusted for time trend, season, influenza, and smoking prevalence. Results: In counties with the highest unemployment, an immediate 30% reduction in ischemic heart disease (IHD) (RR: 0.70; 95% CI: 0.56-0.87), a 41% reduction in stroke (RR: 0.59; 95% CI: 0.43-0.80), and a 43% reduction in chronic obstructive pulmonary disease (COPD) (RR: 0.57; 95% CI: 0.38-0.85) mortality was observed. Similar reductions were detected in counties with the highest household crowding, the lowest education, and the lowest professional occupation. Mortality effects in counties with low unemployment, low household crowding, high education, and high professional occupation were either non-significant or smaller in magnitude compared to effects observed in less privileged counties. The only exceptions were the similar 43% COPD reductions in counties with low household crowding and 30% IHD reductions in counties with high professional occupation. Analyses are ongoing to examine mortality effects by additional, individual SES indicators and a composite index. Conclusions: Comprehensive smoking ban policies can be effective public health interventions for reducing SES inequalities in smoking-related mortality.

Abstract Number	**O-2-30-05**
Presenter	Christie Drew*, Kristiana Pettibone
Exposure	no exposure
Health domains	policy
Type of research	others

Measuring Impacts from Public Health Research

BACKGROUND: The importance of measuring progress towards goals was recently highlighted in the Gates Foundation Annual Letter[1]. Public health researchers sometimes struggle to make direct connections between their activities and interventions with longer term public health impact. The Evaluation Metrics Manual[2], a resource developed by the National Institute of Environmental Health Sciences (NIEHS), can help researchers articulate their goals and develop tangible metrics of progress toward their achievement. This paper will review the Manual, which promotes the use of logic models to demonstrate linkages among research project activities, outputs, and impacts. Particular attention will be given to using logic models to develop specific metrics of public health impact that go beyond typical measures such as counts of peer reviewed publications and journal impact factors. AIMS and METHODS: NIEHS grantees asked for help in understanding and documenting the impacts and outcomes of their work. In response, we developed the Manual based on environmental public health literature, interviews with grantees and reviews of their projects. CONCLUSION: Good measurement is critical for documenting impact. Researchers and science managers benefit from better measurement and evaluation approaches in that they are better able to: identify and publicize program achievements; determine whether a project worked and why (or why not); identify areas for improvement; describe expenditures; justify a need for additional funding; and inform policy and other decision making. [1] Gates, Bill. (2013). Annual Letter from the Bill & Melinda Gates Foundation. http://annualletter.gatesfoundation.org/ [2] NIEHS (2012). Partnerships for Environmental Public Health Evaluation Metrics Manual. http://www.niehs.nih.gov/pephmetrics

Abstract Number	**O-2-30-06**
Presenter	Adetoun Mustapha*
Exposure	green spaces
Health domains	ethics
Type of research	review

Getting ready for the ''tipping point'- Will rapid urbanization potentiate mega-public health issues in resource-poor settings? (e*)

Most economic production takes place in urban centres where cities provide improved access to education, jobs, goods and services. Movement of people from rural to urban areas in resource poor settings, however, does not often yield a greener pasture because urban sprawl is leading to slums, inadequate infrastructure, unplanned cities riddled with escalating incidence and severity of various forms of violence, traffic, under-employment, poverty, diseases and extremely cumbersome city administrative systems. The United Nations World Urbanization Prospects report predicts that by 2050, 64.1% and 85.9% of the developing and developed world, respectively, will be urbanized. In 2011, the world included 23 megacities each with at least 10 million inhabitants; it is projected to increase to 37 in 2025. The number of large cities with populations ranging from 5 to under 10 million is also expected to increase from 40 in 2011, to 59 in 2025, with over three quarters of them being located in developing countries. Virtually all of the expected growth in the world population will be concentrated in the urban areas of the less developed regions (especially in Africa and Asia), whose population is projected to increase from 2.7 billion in 2011 to 5.1 billion in 2050. Impacts of ecosystem disturbance through urbanization have tended to be researched on a global scale. Research is sparse on the nature of challenges that new urban areas concentrated in developing countries pose to regional public health. Such areas lack infrastructure to support rapid growth. What are the ethical issues with allowing cities to grow spontaneously and haphazardly? Is the environmental epidemiology research community promoting an adequate duty of care over vulnerable populations to address emerging threats, including destroying the social fabric of families and entire societies, and changing cultural landscapes and lifestyles from rapid urbanization? This presentation aims to provide opportunity for the audience to identify and discuss the ethical issues in the session's presented papers.

Abstract Number	**O-2-31-01**
Presenter	Richard T. Burnett, Pope C.a III, Ezzati Majid, Olives Casey, Lim Stephen S., Mehta Sumi, Shin Hwashin, H. Ross Anderson, Smith Kirk R, Aaron J. Cohen*
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

An Integrated Exposure-Response Function for Estimating the Global Burden of Disease Attributable to Ambient PM2.5 Exposure

Estimating the global burden of disease attributable to long-term exposure to ambient PM2.5 requires cause-specific mortality relative risk (RR) functions which must apply over a global range of annual average concentrations from < 10 µg/m3 to >100 µg/m3. Cohort studies of long-term exposure to PM2.5 and mortality from chronic disease have not been conducted in the most polluted regions of the world, and there is little direct evidence to identify the shape of mortality RR functions at high ambient concentrations.We developed RR functions for the 4 leading global causes of adult mortality: ischemic heart disease (IHD), cerebrovascular disease (Stroke), chronic obstructive pulmonary disease (COPD), and lung cancer (LC)) over the global range of annual average PM2.5, and an additional risk function for incidence of acute lower respiratory illness (ALRI) in children < 5 years.We fit eight functional forms of a RR model to RR from different combustion sources on a common PM2.5 scale, integrating RR from studies of ambient PM2.5 (AAP), second hand smoke, household solid fuel use, and active smoking to estimate unknown model parameters. We simulated the uncertainty in RR predictions based on uncertainty in input RR values due to sampling error and model fit. We estimated the Population Attributable Fractions (PAF) for ambient PM2.5 for 187 countries using PM2.5 concentrations estimated at a 10km x 10km spatial resolution.A three-parameter exponential decay saturation model with a power of PM2.5 concentration fit best across the five health outcomes. The country-specific PAF (%) for AAP estimated from this model varied from: 2-41 for IHD, 1-43 for Stroke, <1-21 for COPD, <1-25 for LC, and <1-38 for ALRI.PM2.5 mass -based RR models for cause-specific mortality can be developed that cover the global range of exposure to AAP by integrating RR information from different combustion sources of PM2.5. A specific RR model form was identified that provides superior predictive power compared to a range of alternative model forms.

Abstract Number	**O-2-31-02**
Presenter	Giorgia Randi*, Michela Baccini, Paolo Grillo, Dario Consonni, Pietro Alberto Bertazzi, Annibale Biggeri
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Mortality and morbidity health impact assessment of exposure to PM10 and NO2 in Lombardy, Italy

BackgroundIn the last decade, scientific literature has identified air pollution as one of the most relevant problems for the health of people living in urban areas. Health impact assessment is essential to help decision-makers developing specific health policies. AimsTo assess the short-term impact of PM10 and NO2 on the population's health of the whole region of Lombardy, Italy (over nine million people in one of the two most polluted European areas). Methods Estimates of PM10 and NO2 short-term effects on all-cause and cause-specific mortality and on selected causes of hospital admissions were obtained for the period 2003-2006 using Poisson regression models for the main urban areas and random-effect Bayesian meta-analysis for the overall effect. The impact was evaluated in terms of numbers of attributable deaths and hospitalizations in the year 2007, under several counterfactual scenarios of air pollution reduction. ResultsThe annual average PM10 levels exceeding the WHO threshold of 20 µg/m3 were responsible at regional level for 709 attributable deaths (202 cardiovascular and 242 respiratory) and for 192 cardiac, 274 cerebrovascular, and 862 respiratory hospital admissions. Corresponding values above the EU limit of 40 µg/m3 were 173 attributable deaths (43 cardiovascular and 56 respiratory) and 44 cardiac, 60 cerebrovascular, and 193 respiratory hospital admissions. The annual average NO2 levels exceeding the WHO limit of 40 µg/m3 were responsible for 450 attributable deaths (238 cardiovascular and 24 respiratory) and for 471 cardiac, 286 cerebrovascular, and 471 respiratory hospital admissions. A 20% reduction in PM10 or NO2 levels could reduce by at least 30% the burden of short-term deaths and hospitalizations attributable to ambient air pollution. ConclusionsPolicies for air pollution reduction, even by limited amounts, could have immediate impact in terms of avoided deaths and hospital admissions in highly polluted areas.

Abstract Number	**O-2-31-03**
Presenter	Zoe Chafe*, Michael Brauer, Zbigniew Klimont, Kirk R. Smith
Exposure	ambient air pollution
Health domains	policy
Type of research	exposure modeling

Contribution of Household Heating with Solid Fuels to Ambient Particulate Air Pollution (PM2.5)

Background: Incomplete combustion of solid fuels for household heating is a significant source of health-damaging fine particulate matter (PM2.5) and climate forcing black carbon, particularly in temperate areas during winter. With 3.2 million deaths per year attributable to ambient PM2.5 (APM2.5), a better understanding of the contribution of specific sources, including household heating, is needed. Recent work has shown that globally about 15% of APM2.5 emissions are due to household cooking with solid fuels; this proportion is much higher in some countries. No assessment has yet been made of the contribution of household heating to APM2.5 worldwide. Aims: We estimate the proportion of ambient APM2.5 attributable to residential wood and coal heating emissions in 1990-2010 in 176 countries. With these results, we then estimate ambient concentrations of PM2.5 attributable to household heating with solid fuels (PM2.5-heating). Methods: We use an energy supply-driven emissions model (GAINS) to calculate the fraction of household PM2.5 emissions from heating with solid fuels, by country. We apply this fraction to global estimates of average ambient population-weighted anthropogenic PM2.5 concentrations, calculated with source-receptor model TM5-FASST, to obtain the proportion of total APM2.5 from PM2.5-heating. Results: Initial analysis for 2010 indicates that emissions from household heating with solid fuels caused >5% of population-weighted APM2.5 in 80 countries (home to 3.2 billion people), including 20-26% of APM2.5 in 17 countries. In 52 countries, PM2.5-heating exceeded PM2.5 emissions from transportation. Conclusions: PM2.5-heating constitutes an important portion of APM2.5 pollution in many regions. Reducing emissions from household fuel combustion may have significant health advantages for populations far beyond those using solid fuels themselves. Efforts to improve ambient air quality will be hindered if incomplete combustion of solid fuels for household heating is not addressed.

Abstract Number	**O-2-31-04**
Presenter	Catherine Bouland, Michele Rasoloharimahefa Rasamoela*, Marko Tainio, Jurgen Buekers, Ana Isabel Miranda, Marialuisa Volta, Emile De Saeger, Ioannis Douros, Alain Clappier, Catherine Bouland
Exposure	ambient air pollution
Health domains	other
Type of research	review

Health impact in integrated assessment of air quality in Europe - APPRAISAL

Background : Exceedances of ambient air quality values in urban areas in Europe remain common. It concerns particularly PM, NOx and O3. Exceedances are not only a compliance issue; they have significant implications for the health and the well-being of citizens. APPRAISAL is a FP7 project on “Integrated Assessment of air pollution supporting the revision of the air quality legislation at European level” involving 15 partners from different member states. It aims to consolidate knowledge and good practices on air pollution assessment and make it accessible to local and regional policy makers. An overall review of current integrated assessment methodologies deals with: synergies across spatial scales, air quality assessment, health impact assessment (HIA), source apportionment and uncertainties. It also includes methodologies from a simple scenario to a more comprehensive scheme such as cost-effectiveness analysis. Aims : The overall project aims to provide insights on the existing integrated assessment, to support local and regional implementation and integrate current research findings. The focus on HIA questions relationship to exposure, air quality and not only quantity of pollutants but also intrinsic characteristics that would affect health to allow better decision. Methods : A questionnaire was used to collect, in a common format, information on the methodologies used, to identify current practices, strengths and weaknesses and derive guidelines for users. Results : The pilot phase collected 53 questionnaires, on research activities and air quality action plans. Some only included HIA. A description of the various parameters will identify opportunities, strengths and difficulties in implementing HIA at local and regional levels. Conclusions : The comparison of current practices in HIA for the purpose of air quality action plans and the state-of-the-art will provide information for the revision of integrated assessment and its use at both local and regional levels.

Abstract Number	**O-2-31-05**
Presenter	Brian Miller*, Fintan Hurley, Ranjeet Sokhi, Menno Keuken, Bert Brunekreef
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Health Impact Assessment of long-term exposure to particulate air pollution: methodological and practical considerations.

Background Quantitative Health Impact Assessment (HIA) aims to create predictions of the impacts on health of changes in the human environment. Typically, this requires the assessor to bring together data on the environmental changes envisaged, the populations affected, and the health outcomes likely to be impacted by the changes. At the heart of the calculations will be a concentration-(or exposure- or dose-)response coefficient or function, quantifying how environmental change is expected to increase or decrease the rate of the health outcome in the population. Any HIA requires clear statements of the question(s) being asked: are we interested in quantifying the current health burden against a (counterfactual) cleaner scenario; or is our focus the future effects of policy changes; or perhaps both? Methods It’s been widely accepted that particulate air pollution affects mortality: although other health effects are also related, mortality dominates multiple-outcome assessments. Recent evidence has accumulated that points to risks for cardiovascular death in particular. HIAs based on mortality usually rely on the application of life-table methods to predict changes in life expectancy, but burden calculations require many assumptions, and predictions about the future many more. These, and the availability of input data for calculations, will inform the design of a HIA. These issues have arisen in EU projects such as CAFE and HEIMTSA; in work for the UK government’s Committee on the Effects of Air Pollutants (COMEAP) e.g. for their report of 2010; and as part of the English health service’s localisation agenda. Many of the issues involved will be illustrated in detail in the context of case studies of the health effects of transport policies on cities, within the current EU project TRANSPHORM.

Abstract Number	**O-2-31-06**
Presenter	Guoxing Li*, Xiaochuan Pan
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Disease Burden Caused by PM2.5 in Several Chinese Big Cities

Background Numerous epidemiological researches have provided convincing evidence that ambient PM2.5 (particles with an aerodynamic diameter less than 2.5μm) showed adverse effects to human health. Compared with western developed countries, such as Europe and United States, PM2.5 concentration is obviously higher in China, so the disease burden caused by PM2.5 has attracted more and more attention in China. Aims To explore the disease burden caused by PM2.5 in several Chinese big cities, including Beijing, Shanghai, Guangzhou, Xi'an. Methods two steps were used to evaluate the disease burden caused by PM2.5. In the first step, exposure response relationship modeling between PM2.5 exposure concentration and health outcome were built to calculate the excess mortalities caused by PM2.5. Secondly, we assessed the economic cost due to the excess mortalities, basing on the results of one World Bank report (2010). Results the number of excess mortalities caused by PM2.5 in Beijing, Shanghai, Guangzhou, Xi'an were 2349, 2980, 1715, 726, and economic costs were 1.86,2.37,1.36,0.58 billion RMB in 2010. Based on the demographic information of the four cities in 2012, we projected PM2.5 related disease burden in several different scenarios in 2012. If the PM2.5 concentration remained the same as that in 2010, the number of excess mortalities caused by PM2.5 in Beijing, Shanghai, Guangzhou, Xi'an were 2589、3317、1926、739, and economic costs were 2.06, 2.64, 1.53, 0.59 billion RMB in 2010. We also calculated the potential health and economic benefit according to Chinese national PM2.5 standards and WHO guideline, the results showed that if these cities can effectively lower their PM2.5 level, PM2.5 related mortalities and economic costs would be reduced obviously. Conclusions PM2.5 has posed a great threat to population health and big economic cost in China, and stricter emission policies need to be implemented to control ambient PM2.5 pollution.

Abstract Number	**O-2-33-01**
Presenter	Jennifer Nguyen*, Joel D. Schwartz, Douglas Dockery
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure measurement

The relationship between indoor and outdoor temperature, apparent temperature, relative humidity, and absolute humidity

Background Many studies report an association between outdoor ambient weather and health. Outdoor conditions may be a poor indicator of personal exposure because people spend most of their time indoors. Few studies have examined how indoor conditions relate to outdoor ambient weather. Aims To examine how indoor temperature and humidity relate to outdoor weather observations. Methods We compared the average daily temperature, apparent temperature, relative humidity (RH), and absolute humidity measured in 16 homes in Boston, Massachusetts, USA from May 2011 - April 2012 using HOBO U8 and U12 Temperature and RH Data Loggers (Onset Corporation; Bourne, Massachusetts) to National Weather Service measurements taken at Boston Logan International Airport. Results The relationship between indoor and outdoor temperature is non-linear. At warmer outdoor temperatures, there is a strong indoor-to-outdoor correlation (Pearson correlation coefficient (r) = 0.91, slope per outdoor unit (β) = 0.41), but at cooler temperatures, the association is weak (r = 0.40, β = 0.04). Results were similar for apparent temperature. In contrast, the relationship between indoor and outdoor humidity is linear. RH is modestly correlated (r = 0.55, β = 0.39), while absolute humidity is very strongly correlated indoors-to-outdoors (r = 0.96, β = 0.69). Conclusions Indoor and outdoor temperatures correlate well only at warmer outdoor temperatures. Outdoor RH is a poor indicator of indoor RH, while indoor absolute humidity is strongly correlated with outdoor values year-round. These results suggest that, of these four measures, absolute humidity is the best indicator of personal exposure. These results also show that outdoor temperature is a poor indicator of indoor temperature exposure during cooler months in the New England region, USA. Studies relating outdoor weather to human health should verify that outdoor conditions are a good indicator of indoor or personal weather exposure in the studied geographical area.

Abstract Number	**O-2-33-02**
Presenter	Ashlinn Quinn*, James Tamerius, Judith S. Jacobson, Matthew Perzanowski, Jeffrey Shaman, Patrick Kinney
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure measurement

Summertime indoor-outdoor temperature and humidity relationships in New York City residences

Background: A growing body of literature indicates that increased temperature is associated with morbidity and mortality. Existing models of population risk typically rely on outdoor measurements of heat and humidity. However, residents of industrialized countries spend more than 90 percent of their time indoors (EPA, 1989). Clarification of the relationship between heat and humidity exposures and health outcomes requires a more detailed understanding of these exposures in the indoor environment. Aims: To analyze the associations of outdoor and indoor temperature and humidity in New York City residences, taking building and socioeconomic factors into account. Methods: We analyzed indoor temperature and humidity observations collected from 330 homes in NYC during the summers of 2003-2011. Each home was monitored for 5-13 days. The homes were the residences of participants in two studies: Endotoxin, Obesity, and Asthma in NYC Head Start; and the New York City Neighborhood Allergy and Asthma Study. Outdoor weather data was drawn from the three main New York City weather stations (JFK, LGA, NYC) and missing values were imputed with modeled data. Results: The correlation between indoor and outdoor humidity, measured as dewpoint temperature, was stronger than that between indoor and outdoor temperature (R2 = 0.60 for dewpoint temperature and 0.34 for temperature). Indoor summer temperature rose on average 0.4ºC with every 1ºC increase in outdoor temperature. At temperatures below 28ºC, mean temperatures indoors were warmer than outdoors. Indoor temperatures exhibited a strong diurnal cycle, but the amplitude of this cycle was muted compared to the outdoor cycle. Conclusions: Our data represent quantitative estimates of health-relevant exposures to heat and humidity in indoor residential environments in New York City. Further research is needed on these relationships in urban environments and on how heat and humidity affect specific health outcomes in these settings.

Abstract Number	**O-2-33-03**
Presenter	Brooke Anderson*, Michelle L. Bell, Roger Peng
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure measurement

Methods to calculate the heat index as an exposure metric in environmental health research

BACKGROUND: Environmental health research employs a variety of metrics to measure heat exposure, both to directly study the health effects of outdoor temperature and also to control for temperature in studies of other environmental exposures, including air pollution. To measure heat exposure, environmental health studies often use heat index (e.g., apparent temperature), which incorporates both air temperature and moisture. However, the method of calculating heat index varies across environmental studies, which could mean that studies using different algorithms to calculate heat index may not be comparable. AIMS AND METHODS: We investigated 22 separate heat index algorithms found in the literature to determine: (1) if different algorithms generate heat index values that are consistent with the theoretical concepts of apparent temperature and (2) if different algorithms generate similar heat index values. RESULTS: Although environmental studies differ in how they calculate heat index values, most studies' heat index algorithms generate values consistent with apparent temperature. Additionally, most different algorithms generate closely correlated heat index values. However, a few algorithms are potentially problematic, especially in certain weather conditions (e.g., very low relative humidity, cold weather), and identification of heat waves can vary substantially between algorithms. To aid environmental health researchers, we have created open-source software in R to calculate the heat index using the United States National Weather Service's algorithm. CONCLUSION: We identified 22 separate heat index algorithms used in environmental research, which demonstrated that methods to calculate heat index are inconsistent across studies. Careful choice of a heat index algorithm can help ensure reproducible and consistent environmental health research.

Abstract Number	**O-2-33-04**
Presenter	Shilu Tong*, Jiajia Wang, Gail Williams, Paul Colditz, Weiwei Yu, Xiaochuan Pan
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	case-control study

Maternal exposure to a heatwave and the risk of preterm birth

Background: A few studies have assessed the relationship between exposure to ambient temperatures during pregnancy and the risk of preterm birth (PTB) but little is known about the impact of maternal exposure to a heatwave on the occurrence of PTB. Aims: To examine the relationship between maternal exposure to a heatwave and the risk of PTB in Brisbane, Australia, during 2000-2010. Methods: We obtained the daily data on sociodemographic factors, air pollutants and meteorological factors and stillbirths for Brisbane, Australia, during 2000-2010 from relevant government agencies. Logistic regression model was used to examine the relationship between maternal exposure to a heatwave and the risk of PTB, after adjusting for maternal age, parity, indigenous status and infants' gender, socioeconomic index for area , relative humidity, air pressure and air pollution. Results: There was a statistically significant association between maternal exposure to a heatwave and the risk of PTB. The relative risk for PTB was 1.25 (95% confidence interval (CI): 1.15-1.35), 1.15 (95% CI: 1.07-1.24), and 1.28 (95% CI: 1.18-1.39) for maternal exposure, in the 1st trimester, to a heatwave defined as daily maximum temperatures > the 90th percentile for 2, 3 or 4 days, respectively. However, no apparent association was observed for maternal exposure to a heatwave in the 2nd or 3rd trimester. Similar results were found when we changed the definition of heatwave (e.g., maximum temperatures > the 95th percentile for 2 or more consecutive days). Conclusions: Maternal exposure to a heatwave during early pregnancy is a significant risk for PTB. Further research is necessary to detail the likely important implications of this finding for the improvement of prenatal care.

Abstract Number	**O-2-33-05**
Presenter	Haritini Tsangari*, Anastasia Paschalidou, Pavlos Kassomenos, Zoi Konsoula, Stephanie Christou, Kyriakos, E. Georgiou, Theodoulos Mesimeris, Sotiris Vardoulakis, Clare, H. Heaviside, Edna, N. Yamasaki
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure modeling

The effect of extreme weather on mortality in Cyprus: high temperatures vs. synoptic air mass types

Background: The world is experiencing climate change which is likely to lead to increased mortality associated with extreme weather. Aims: The current study (CYPHEW) is the first to examine the effect of extreme weather on mortality in the Mediterranean island of Cyprus. The objective was to investigate the impact on mortality of individual meteorological variables (e.g. temperature), and synoptic weather classifications (air mass types) that define categories of meteorologically homogeneous days. Methods: Daily data were analyzed for the warm period (April-September) of 2004-2009. A Generalized Linear Model (GLM) was used. First, temperature was entered in GLM with a newly developed Distributed Lag Non-linear Model, which captures non-linearities and lag effects simultaneously. The GLM was also adjusted for relative humidity, long- and short-term seasonality. Second, considering variables like air and dew point temperature, barometric pressure, precipitation, sunshine and visibility, Principal Component Analysis and Cluster Analysis were used to identify the air mass types and their effect was examined. Results: High temperatures had a significant effect on mortality in Cyprus. The V-shaped temperature-mortality relation had a hot temperature threshold at 33.7oC, above which mortality risk increased steeply. Moreover, a direct health effect of heat was shown, with high risk on the current and next two days of a severe heat event. Seven air mass types were identified, but none had a significant effect on mortality. Conclusions: The CYPHEW study indicated that high temperatures can result in increased mortality rates in Cyprus, independent of humidity and seasonality. Other meteorological variables in air mass types were not associated with excess mortality risk. The results could be used to inform a Heat-Health- Warning System. The Project CYPHEW is co-financed by the European Regional Development Fund and the Republic of Cyprus through the Research Promotion Foundation

Abstract Number	**O-2-33-06**
Presenter	Shanshan Li*, Bin Jalaludin, Peter Baker, Guy Marks, Gail Williams
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	others

Are children's asthmatic symptoms related to ambient temperature? A national panel study in Australia

Background: There is strong evidence that extreme temperatures increase the risk of mortality and morbidity. Children with asthma are known to be one of the most sensitive groups to weather change. However, very few studies are available which assess the relationship between ambient temperature and respiratory symptoms in children with asthma. Aims: We aimed to examine the short-term effects of ambient temperature on respiratory symptoms for school children with asthma across Australia. Methods: A panel of 270 children (7-12 years) with asthma was recruited from six Australian cities. They were asked to record their respiratory symptoms every day in the morning (for night-time symptoms) and evening (for daytime symptoms) for four weeks. Daily ambient temperature and air pollution data were obtained from fixed monitors nearby. A mixed logistic regression model was used to examine the effects of ambient temperature on respiratory symptoms, adjusted for children's sex, age, standing height, weight, and air pollution. Subjects were specified as random effects. Results: The relationships between ambient temperature and respiratory symptoms were linear. Increasing temperatures induced the risks of children's asthmatic symptoms, especially for "wheeze / chest tightness" than for "cough / phlegm". The effects were acute and lasted for four days (lag 0-3) in general. Boys showed more at risk than girls by ambient temperature increasing. Conclusions: High ambient temperature is risk factor on respiratory symptoms for children with asthma. As ambient temperature has been rising due to climate change, policy for climate change adaptation is necessary to protect children's health. Keywords: Asthma; children; panel study; respiratory symptoms; temperature

Abstract Number	**O-2-34-01**
Presenter	Susanna Lagorio*
Exposure	ambient air pollution
Health domains	cancer
Type of research	case-control study

Exposure to benzene and childhood leukaemia: a pilot case-control study

Background Benzene causes AnLL in adults. Aims A pilot study was performed in order to: evaluate the feasibility of a measurement-based assessment of benzene exposure in epidemiologic studies of childhood leukaemia; identify the sources of exposure variability; assess the performance of two benzene biomarkers; verify the occurrence of participation bias; check whether exposures to benzene and to 50 Hz magnetic fields were correlated, and might exert reciprocal confounding effects. Methods Eligible for inclusion were 108 cases and 194 controls. Benzene exposure was assessed by repeated seasonal weekly measurements in breathing zone air samples and outside the children's dwellings, with concurrent determinations of cotinine, t-t-MA, and S-PMA in urine. Results Full-participation was obtained from 46 cases and 60 controls, with low dropout rates before 4 repeats (11% and 17%); the outdoor monitoring was accepted by 64% of cases and 72% of controls. The average benzene concentration in personal and outdoor air samples was 3 µg/m3 (SD 1.45) and 2.7 µg/m3 (SD 1.41), respectively. Personal exposure was strongly influenced by outdoor benzene concentrations, higher in the cold seasons than in warm seasons, and not affected by gender, age, area of residence, or caseness. Urinary excretion of S-PMA and personal benzene exposure were well correlated. A participation bias was indeed present, and its direction was found to depend on the cut-point chosen to distinguish exposed and unexposed. Exposures to benzene and ELF-MF were positively correlated. Conclusions Repeated individual measurements are needed to account for the seasonal variability in benzene exposure, and have the additional advantage of increasing the study power. Epidemiologic studies of childhood leukaemia and measurement-based estimates of exposure to benzene are challenging but logistically feasible.

Abstract Number	**O-2-34-02**
Presenter	Pornpun Watcharavitoon*, Chan Chang-Chuan, Yu Hwa-Lung, Wu Kuen-Yuh
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure modeling

Spatiotemporal distributions of Benzene exposure and risk assessment on Bangkok residents.

Benzene is classified as a "known" human carcinogen. High concentrations of benzene in the Bangkok Metropolitan Region (BMR) are considered to be most serious in Thailand. The aim of this study is to estimate cancer risk for Bangkok residents exposed to benzene. The data on environmental benzene concentration in Bangkok were collected by the Environmental Research and Training Center (ERTC), Thailand, from November 2006 to September 2007. Air samples were collected once a month covering both weekdays and weekends at 11 different stations, which included 5 roadside sites, 5 residential sites and 1 background site. Benzene measurement techniques were based on the US.EPA Method TO-15. Each air sample was collected for a period of 24 ± 1 hour. Extrapolated benzene concentration distribution and exposure assessment by using S/TRF model. The individual lifetime cancer risk can be determined by using quantitative estimate of carcinogenic risk from inhalation exposure, with the incorporation of STBME software. The annual average concentration in the inner city between the ambient-roadside areas and the ambient-residential areas were almost 4.0 and 1.2 times higher than that observed in the background areas. The calculated lifetime cancer risk ranged from 9.67E-11 to 2.82E-5 in Bangkok. There were about 0 - 29 cancer cases/million of population over a 70-year period among the people living and working in different areas as reflect by the characteristic and traffic volume in Bangkok. Keywords:Benzene; Spatiotemporal; STBME software; Cancer risk; Bangkok residents.

Abstract Number	**O-2-34-03**
Presenter	Ole Raaschou-Nielsen*, Zorana Jovanovic Andersen, Rob Beelen, Konstantina Dimakopoulou, Wei Xun, Klea Katsouyanni, Bert Brunekreef, Paolo Vineis, Gerard Hoek
Exposure	ambient air pollution
Health domains	cancer
Type of research	meta-analysis

Air pollution and lung cancer incidence; 17 European cohort studies within the ESCAPE project

Background: Ambient air pollution, and in particular particulate matter (PM), is suspected to cause lung cancer. Aims: To estimate associations between long-term exposure to air pollution at the residence and lung cancer incidence in European populations. Methods: We used individual data from 17 European cohorts. Baseline addresses were geocoded and air pollution was assessed by land-use regression models for PM below 10 µm (PM10), below 2.5 µm (PM2.5), between 2.5 and 10 µm (PMcoarse), PM2.5absorbance, nitrogen oxides and two traffic indicators. We used Cox regression models with adjustment for potential confounders for cohort-specific analyses and random effects models for meta-analyses of the cohort-specific results. Results: We included 312,944 cohort members contributing 4,013,131 person-years at risk and 2095 incident lung cancer cases developed during the follow-up of on average 12.8 years. The meta-analyses showed that a 10 µg/m3 increase in PM10 was associated with a 22% (95% confidence interval [CI]: 3 to 45%) increase in risk for lung cancer, a 5 µg/m3 increase in PM2.5 was associated with an 18% (95% CI: -4 to 46%) increase in risk. Similar increments of PM10 and PM2.5, respectively, were associated with 49% (95% CI: 8 to 105%) and 55% (95% CI: 5 to 129%) increase in risk for adenocarcinomas of the lung. An increase in road traffic of 4000 vehicle-km/day within 100 m of the residence was associated with a 9% (95% CI: -1 to 21%) increase in risk for lung cancer. Associations between PM air pollution and lung cancer were also detected among never smokers. The results showed no association for nitrogen oxides or traffic on nearest street. Conclusions: This study showed associations between particulate matter air pollution and lung cancer incidence in Europe.

Abstract Number	**O-2-34-04**
Presenter	Amit Masih*, Ajay Taneja, Raj Singhvi
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	exposure measurement

Exposure profiles and related carcinogenic potencies of polycyclic aromatic hydrocarbons (PAHs) in aerosols of an urban site in the north central part of India

Over the past two decades there has been a rapid increase in urbanization and industrialization in many cities of India. The industrialization/ urbanization process has both positive and negative effects on ambient air quality in many cities of the world. Polycyclic aromatic hydrocarbons (PAHs) are neutral, non-polar organic molecules that comprise two or more benzene rings arranged in various configurations. Members of this class compounds have been identified as exhibiting toxic/hazardous properties, moreover they are the major culprits in urban areas causing human lung cancer. Particulate matter from an urban site within Agra city (a semi-arid region) were collected using respirable dust samplers for a span of one year (2007-2008) in order to study the concentration and exposure profiles of PAHs. The samples were extracted with dichloromethane using an automated Soxhlet Extraction System (Soxtherm®). The extracts were analyzed for 17 target Polycyclic Aromatic Hydrocarbons (PAHs). The total PAH (TPAH) concentrations were 27.96 ± 2.3, 22.24 ± 2.1, and 34.38 ± 3.0 nanograms per cubic meter (ng m-3), respectively, during summer, monsoon and winter seasons. The combined mean concentration of TPAH was 28.19 ngm-3 for all seasons. Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, Benzo(k)fluoranthene and Benzo(g,h,i)perylene were the chief PAHs found in the samples collected from this urban region. The average TPAH percentage based on the number of rings were 1% (2-ring), 2% (3-ring), 24% (4-ring), 48% (5- ring), and 25% (6-ring). Benzo(a)pyrene contributed the highest carcinogenic exposure equivalent (2.80 ng m-3) followed by Dibenz(a,h)anthracene (1.14 ng m-3), Benzo(b)fluoranthene (0.453 ng m-3), Indeno(123cd)pyrene (0.409 ng m-3), Benzo(k)fluoranthene (0.338 ng m-3) and Benzo(a)anthracene (0.121 ng m-3), accounting for approximately 54%, 22%, 8%, 7%, 6% and 2% of the total carcinogenicity of particulate PAH in this urban region, respectively. Source apportionment (principal component analysis) suggests that the mixed signature of all the sources are intermediate between vehicular and combustion activities.

Abstract Number	**O-2-34-05**
Presenter	Chiara Badaloni, Alessandra Ranucci, Giulia Cesaroni*, Gabriele Zanini, Danielle Vienneau, Fatima Al-Aidarous, Kees de Hoogh, Magnani Corrado, Francesco Forastiere, Setil Study Group
Exposure	ambient air pollution
Health domains	cancer
Type of research	case-control study

Air pollution and childhood leukaemia: a nationwide case-control study in Italy

Background: Leukaemia is the most common cancer in children, but its aetiology is still poorly understood. Traffic air pollution has been suggested as a possible risk factor for this disease, because of chronic exposure to several potential carcinogens. Aims: We tested the hypothesis that air pollution (particulate matter, nitrogen dioxide, ozone and GIS indicators of traffic exposure at residence) is associated with paediatric leukaemia. Methods:The Italian SETIL study (Study on the aetiology of lymphohematopoietic malignancies in children) was conducted in 14 Italian regions. All 683 incident cases of leukaemia in children aged ≤10 years from these regions (period 1998-2001) were eligible for enrolment. Two controls per case (1,044), matched on birthdate, gender and region of residence were randomly selected from Local Health Authorities population registries. Exposure assessment at residence at birth included: traffic density and fixed air pollutant sources in proximity of the children's dwelling reported by parents at interview; GIS land use variables (distance to main roads and length of main roads within 100m); estimates of pollutants concentrations (PM2.5 from dispersion model at 16 km2 resolutions and PM10, NO2 and O3 from hybrid model, based on satellite observations and land use variables, at 100x100m resolution). The association between the exposure variable and leukaemia was assessed by logistic regression models. Results: Participation rates were 91.4% among cases and 69.2% in controls; 620 cases (544 ALL; 76 AnLL) and 957 controls were included. Overall, 35.6% of cases and 42.4% of controls lived along busy roads and the PM2.5 levels were, on average, 33.6 (SD=6.3) and 33.4 µg/m3 (SD=6.5) respectively. No association was found and all odds ratios, independent of the method of assessment, were close to the null value. Conclusions: In our large study, using various exposure assessment strategies, air pollution appears not to affect the incidence of childhood leukaemia.

Abstract Number	**O-2-34-06**
Presenter	Robin Puett*, Jaime E. Hart, Jeff Yanosky, Donna Spiegelman, Molin Wang, Francine Laden
Exposure	ambient air pollution
Health domains	cancer
Type of research	cohort study

Chronic Particulate Matter Exposures and Lung Cancer in the Nurses' Health Study Cohort

Background Occupational air pollution exposures have been consistently associated with increased lung cancer risk. Few studies have examined the association of long term air pollution in the general population. Aims To determine if long term ambient exposures to particulate matter (PM) PM2.5, PM10 and PM2.5-10 are associated with an increased risk of lung cancer among women in the Nurses' Health Study (NHS), a US-wide prospective cohort study. Methods Lung cancer cases from 1988 through 2010 were identified through biennial questionnaires and confirmed through medical reports. Information on time varying covariates including age, region of US, smoking, alcohol intake, BMI, physical activity, and area-level socioeconomic status was available. A spatio-temporal statistical model using monitor, meteorological, and other geographic data estimated PM exposures for the three size fractions for each month at each residential address for each participant between 1988 and 2007. Analyses were restricted to women living within metropolitan statistical areas. Results Among 88,033 women, 1,548 cases of lung cancer were identified. Using 10 year cumulative average exposure, the fully adjusted hazard ratio for lung cancer was 1.16 (95%CI: 1.04,1.30) for PM10, 1.27 (95%CI:1.09,1.49) for PM2.5-10, and 1.14 (95%CI: 0.94, 1.40) for PM2.5. Stratified results showed lower risks for current smokers and higher risks among former and never smokers, though the sample size for never smokers was limited (107 cases). Specifically, for never smokers the HRs were 1.20, 1.37,1.15 for PM10, PM2.5-10, and PM2.5, respectively. Conclusions Among this cohort of US women, long-term particulate matter exposures were associated with increased lung cancer risk. Although a small number of cases, the risk appears strongest among never smokers.

Abstract Number	**O-2-36-01**
Presenter	Majid Kajbafzadeh*, Michael Brauer, Barbara Karlen, Ryan W. Allen
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Impacts of Traffic-Related and Woodsmoke Air Pollution on Endothelial Function and Systemic Inflammation

Background: Evidence links combustion-generated particulate matter (PM) with cardiovascular morbidity. Both traffic-related air pollution (TRAP) and residential wood combustion (RWC) may be important, but few studies have compared their impacts. Aims: We evaluated the effects of HEPA filtration and indoor PM2.5 on reactive hyperemia index (RHI) and inflammation (C-reactive protein [CRP] and IL-6) among individuals residing in Vancouver areas impacted by either TRAP or RWC. We aimed to test HEPA efficacy and to introduce similar PM2.5 exposure contrasts in all homes. Methods: In this randomized, single-blind crossover study we enrolled 83 healthy adults (44 homes), from the general population. Each home was monitored over two consecutive weeks (one with HEPA and one with “placebo” filtration). RHI was measured after each week and blood samples were collected at baseline and after each week. Effects were estimated from mixed models with PM2.5 effects reported per median within-home contrast (2.4 µg/m3). Results: This analysis included 51 participants with complete PM2.5, RHI, and blood measurements. Participants in TRAP- (N=34) and RWC-impacted areas (N=17) had similar BMI, baseline CRP, time spent at home, and PM2.5 levels, but TRAP-exposed participants were younger. HEPA filters reduced average indoor PM2.5 levels by 39%, and 92% of homes had reductions, but in intent to treat analysis filtration was not associated with changes in cardiovascular outcomes. PM2.5 was not associated with CRP in the full population; however, PM2.5 reductions were associated with lower CRP among TRAP-impacted (19.2% decrease, 95% CI: 3.2%–37.4%) but not RWC-impacted (11.6% increase, -37.3%–23.5%) participants. There were no associations with RHI or IL-6. Conclusions: Indoor PM2.5 reductions were associated with decreases in CRP, a marker of systemic inflammation, only among those in areas impacted by TRAP. This supports the hypothesis that traffic-related PM2.5 has greater inflammatory effects than other combustion PM.

Abstract Number	**O-2-36-02**
Presenter	Frauke Hennig*, Kateryna Fuks, Susanne Moebus, Anja Viehmann, Gudrun Weinmayr, Michael Memmesheimer, Hermann Jakobs, Raimund Erbel, Karl-Heinz Jöckel, Barbara Hoffmann
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Association between source-specific particulate matter air pollution and hs-CRP – role of fresh local traffic and industrial emissions

Background Long-term exposure to fine particulate matter (PM2.5 and PM10) air pollution and high traffic load at residence have been shown to induce systemic inflammation. So far epidemiological investigations on inflammatory markers have concentrated on effects of total PM2.5 and PM10, a mixture of pollutants originating from different sources. Little is known about source-specific PM and inflammation. Aims To investigate the association of source-specific (local traffic and industry) fine PM and hs-CRP, a widely used marker for systemic inflammation and an independent predictor of cardiovascular disease. Methods We used longitudinal data from the Heinz Nixdorf Recall study,a prospective population-based German cohort of 4814 participants aged 45 to 75 years at baseline (2000-2003).We estimated individual 365-day mean exposure to local traffic- and industry-specific fine PM at participant's residence by suppression of sources within a chemistry transport model. A linear mixed model with a random participant intercept was used to estimate associations of source-specific PM and log-transformed hs-CRP, controlling for age, sex, education, BMI, LDL/HDL, smoking habits, season and humidity. Results Analyzing 8,215 observations in 4,672 participants we observed positive associations between total PM2.5 and hs-CRP with a 2.83 % (95%-CI: 1.41 to 4.27 %) increase in hs-CRP level per 1 µg/m3 increase in total PM2.5. For traffic-specific PM2.5 we saw a 20.00 % (95%-CI: 9.36 to 31.34 %) increase, while the effect of industry-specific PM2.5 could not be separated from total PM due to high correlation (0.9). Results for PM10 were similar. Conclusions Our results suggest that local traffic-specific PM is more closely associated with systemic inflammation than total PM. Further investigations are needed to distinguish properly between total and industry-specific PM. Grant information: This study was funded by the German Research Council (DFG; JO 170/8-1, HO

Abstract Number	**O-2-36-03**
Presenter	Hanne Krage Carlsen*, Thorarinn Gislason, Bertil Forsberg, Kadri Meister, Anna Oudin
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Independent effects of traffic, sandstorm and volcanic particles on emergency hospital visits in Reykjavík, Iceland?

Background After the spring 2010 Eyjafjallajökull volcanic eruption volcanic ash contributed to particulate matter (PM) levels in Iceland. Aims The aim of the present study was to analyze the association between sources of high PM levels and emergency hospital visits in the capital area. Materials and methods The outcomes were acute admissions and emergency department visits for cardiopulmonary, stroke and respiratory causes to Landspitali University Hospital in Reykjavík (pop. 200.000) from 2007 to 2010. Air pollution data and the estimated source of particles of each event where the PM10 health limit (50 µg/m3) was exceeded were obtained from authorities. The data were analyzed using generalized additive regression, with indicator variables for each particle source (traffic, sandstorms, or volcanic ash) the current and two previous days (lag02), adjusted for other pollutants, weather and time trend. Results During the study period the average number daily emergency hospital visits was 10.5. High PM10 levels occurred 91 days, the source was traffic 37 days, sandstorms 11 days, and volcanic ash 9 days. In preliminary analysis, we found that each day with high PM10 levels from traffic were associated with an increase in the number of emergency hospital visits of 9% (95% confidence interval (CI) 1-17%), adjusting for other pollutants and weather. High PM levels due to sandstorms and volcanic ash were not significantly associated with emergency hospital visits when adjusting for other pollutants. In unadjusted models, high PM10 levels due to sandstorms and volcanic ash were nearly significantly ($p<0.10$) associated with emergency hospital visits, increasing 13% (95% CI 0-27%) for volcanic ash and 9% (95% CI -1-21%) for sandstorms. Conclusion In this study of particle sources we identified independent effects of particles originating in traffic, and near-significant effects of volcanic dust and sandstorms.

Abstract Number	**O-2-36-04**
Presenter	Marianthi-Anna Kioumourtzoglou*, Brent A. Coull, Francesca Dominici, Petros Koutrakis, Joel D. Schwartz, Helen H. Suh
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

The Impact of Source Contribution Uncertainty on the Effect of Source-Specific PM2.5 on Cardiovascular Hospital Admissions

Background and aims: Numerous studies have linked particulate sources to a range of health outcomes. They, however, do not account for the uncertainty in the prediction of the source contributions in the health models. Our goal was to estimate the effect of particulate sources on cardiovascular (CVD) health, accounting for the uncertainty in source identification. Methods: We examined the effects of PM2.5 sources on emergency CVD hospital admissions among Medicare enrollees in Boston, MA (2003-2010) using case-crossover analyses. We identified these sources using two methods, Positive Matrix Factorization (PMF) and Absolute Principal Components Analysis (APCA). We propagated uncertainty in the prediction of source contributions employing a block bootstrap procedure. We further estimated average effect estimates across-methods for each source type using the bootstrap samples. Results: We identified six factors: regional, mobile and crustal sources, residual oil combustion, road dust and sea salt. Accounting for uncertainty, same day exposures to regional sources were associated with a 2.01% (0.21, 3.69%) and 1.96% (-0.07, 4.19%) increase in the odds of CVD admissions for PMF and APCA, respectively. Weekly exposures to residual oil combustion were associated with a 2.20% (0.25, 4.30%) and 2.04% (0.08, 4.15%) increase in odds of admissions for PMF and APCA, respectively. Same day and 2-d exposures to traffic-related PM2.5 were also associated with increased CVD admissions. Confidence intervals were wider than would have been if the uncertainty in contribution predictions had not been considered. Further, the agreement in results for PMF and APCA was stronger across factors when uncertainty was considered in the health models. Conclusions: Accounting for uncertainty in source contributions leads to more stable effect estimates across methods and can potentially lead to fewer spurious significant associations and more consistent findings across studies.

Abstract Number	**O-2-36-05**
Presenter	Xavier Basagaña*, Bénédicte Jacquemin, Angeliki Karanasiou, David Agis, Juan Alguacil, Julio Díaz, Xavier Querol, Jordi Sunyer, Bart Ostro, Massimo Stafoggia, the MED-PARTICLES Study Group
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

Effects of particulate matter (PM) sources on mortality in Mediterranean cities: the MED-Particles project

Background: Acute exposure to particulate matter (PM) has been linked to increases in mortality in several studies. Recently, some studies have examined which species and sources in the PM mixture are responsible for these associations, but this is not well documented in Southern Europe. The Mediterranean area has specific characteristics that influence air pollution levels and composition, such as highly urbanized areas with intense traffic, elevated sea traffic, intense solar radiation, and high frequency of wildfires and Saharan dust episodes. Aims: Examine the association between several PM sources and mortality in three Mediterranean cities. Methods: PM10 and PM2.5 concentrations were collected once or twice a week in three Spanish cities, Barcelona (2003-2010), Madrid (2007-2008) and Huelva (2003-2009). Source apportionment using positive matrix factorization was developed for both PM2.5 and PM10. A case-crossover regression analysis will be used to determine the effects of daily exposure to each source and non-accidental, cardiovascular and respiratory mortality for each city. Single-city estimates will be combined using meta-analysis. Results: Source apportionment resulted in three sources that were common in the three cities: traffic, mineral and industrial. Traffic accounted for 47%, 39% and 22% of PM2.5 concentrations in Barcelona, Madrid and Huelva, respectively. The city percentages were 9%, 18% and 13% for the mineral source. The industrial source was only detected in Barcelona and Huelva, where it accounted for 5% and 13% of PM2.5 concentrations. Similar percentages were found for PM10. Taken together, they common sources accounted for an average of between 56% and 71% of PM concentrations. Conclusions: Traffic is one of the main contributors to PM concentrations in the three cities. These sources will be linked to mortality in the subsequent analysis, including more cities, to provide the first multi-city study on health and PM sources in Europe. Acknowledgements: MED-PARTICLES EU LIFE10 ENV/IT/327

Abstract Number	**O-2-36-06**
Presenter	Marloes Eeftens*, Gerard Hoek, Claudia Cramer, Kees de Hoogh, Elaine Fuertes, Olena Gruzieva, Anna Moelter, Meng Wang, Ulrike Gehring
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	meta-analysis

Elemental composition of particulate matter and the association with lung function in 5 European birth cohorts – results of the ESCAPE project

Background Negative effects of long-term exposure to particulate matter (PM) on lung function have been shown repeatedly. We earlier reported a negative association between PM and FEV1 and FVC in children. However, studies have found differences in effect sizes for decreases in FEV1, which may be due to spatial differences in the composition and toxicity of particulate air pollutants. Aims We aimed to study the association between residential exposure to 8 elemental constituents of PM and lung function in 5 similar European birth cohorts. Methods Within the framework of the ESCAPE and TRANSPHORM projects, we conducted a multi-centre study in 5 European birth cohorts: BAMSE (Sweden), GINI and LISA (Germany), MAAS (UK) and PIAMA (The Netherlands), for which lung function indicators (FEV1, FVC and PEF) were available for ages 6-8 years. Individual residential exposure to copper, iron, potassium, nickel, sulphur, silicon, vanadium and zinc within PM size fractions <2.5µm and <10µm was estimated using land-use regression (LUR) models. We used linear regression to analyse the association between air pollution and lung function within cohorts and conducted random effects meta-analysis to combine the cohort-specific estimates. Results LUR models predicted large between-area exposure contrasts for many elements. We observed small reductions in FEV1 in relation to exposure to most elemental pollutants, but none of these associations were statistically significant in both adjusted and unadjusted models, although this differed for individual cohorts. An increased exposure of 200ng/m³ PM10 sulphur was associated with a reduction of 2.40% (95% confidence interval 0.16-4.65%) in FEV1 only in the unadjusted model. An increase of 2ng/m³ PM10 nickel was associated with a 1.57% (0.40-2.74%) decrease in FEV1 in the adjusted model. Conclusions We were unable to detect clear spatial differences in PM toxicity. The 8 evaluated elements were less consistently associated with lung function than fine particle mass.

Abstract Number	**O-2-38-01**
Presenter	Ying-Ying Meng*, Susan Babey, Melissa Pickett, Joelle Wolstein
Exposure	ambient air pollution
Health domains	obesity
Type of research	cross-sectional study

Do Air Pollution Exposure and Food Environment Impact Overweight/Obesity?

Growing evidence suggests environmental factors may contribute to increased prevalence of overweight/obesity. Recent studies link overweight/obesity to increased air pollution exposure, as well as living in an unhealthy food environment. This study examines relationships between increases in criteria pollutant exposure and poor retail food environment (RFE) with increased odds of being overweight or obese. Using 2003 California Health Interview Survey (CHIS) data and Geographic Information System software, we linked adult residential addresses to: 1) government air monitors for O3, PM10 and PM2.5 to estimate individual 3-year average pollutant exposures and 2) respondents' RFE index, a ratio of unhealthy to healthy food vendors within a specified buffer. Using logistic regression analyses, we evaluated associations between both pollutant exposure and RFE and increased odds of being overweight/obese, controlling for age, sex, race, and poverty level. Increased O3, PM10, and PM2.5 were associated with 10%, 12%, and 14% respective increases in odds of being overweight and 13%, 29%, and 15% respective increases in odds of being obese, when controlling for age, sex, race, and poverty level. After adding RFE into the model, positive associations between pollutants and overweight/obesity remained; living in an unhealthy food environment (moderate (4-5.9) or high RFE index (≥6)) was also associated with 6-28% increases in odds of being overweight. Our findings show increased exposure to air pollution and unhealthy food environments may contribute to increases in overweight/obesity. Observed effects of air pollution on weight gain will have wide impact due to high incidence and ubiquity of exposure. To curb these increases, it is necessary to intervene against modifiable, environmental risk factors, such as air pollution and unhealthy food environments, contributing to the nation’s weight gain.

Abstract Number	**O-2-38-02**
Presenter	Peter James*, Jaime E. Hart, Francine Laden
Exposure	others
Health domains	physical activity
Type of research	cohort study

Prospective effects of the built environment on walking and weight gain

Background: Research shows that the built environment is associated with walking and weight, as land use, density, and transportation systems determine the proximity of destinations and the feasibility of walking to them. Few studies have shown prospective associations between the built environment and these outcomes. Aims: To assess the prospective association between the built environment and changes in walking and weight. Methods: We used 1986-2008 data from the Nurses' Health Study, a US-based nationwide prospective cohort of female nurses. Using Census and geographic information systems (GIS) data, we created measures of residential density, business counts (as a proxy for land use mix), and intersection counts (as a proxy for street connectivity) based on 1200m line-based buffers around the participant mailing address at each biennial questionnaire. Self-reported weight (in lbs) and walking (converted to metabolic equivalent hours per week (MET hrs/wk)) was asked on each questionnaire. We ran multilevel longitudinal analyses on the relationship between built environment measures and weight or walking. Results: Of 102,885 participants, mean weight at baseline was 147.2 lbs and mean walking was 6.5 MET hrs/wk. After adjusting for age, race, smoking, individual socioeconomic status, and Census tract income and household value, the highest quintile of intersection count, business count, and population density was associated with a -0.09 (95% confidence interval -0.17, -0.02), -0.12 (-0.19, -0.04), and -0.06 (-0.14, 0.02) change in MET hrs/wk of walking per year compared to the lowest quintile, respectively. The highest quintile of intersection count, business count, and population density was associated with a 0.03 (0.01, 0.04), 0.02 (0.00, 0.03), and 0.00 (-0.02, 0.02) lb weight gain per year compared to the lowest quintile, respectively. Conclusions: We found that higher levels of intersection count, business count, and population density were associated with lower levels of walking and higher levels of weight gain.

Abstract Number	**O-2-38-03**
Presenter	Arpita Husain*, Kevin Lane, Doug Brugge
Exposure	ambient air pollution
Health domains	obesity
Type of research	cross-sectional study

BMI and proximity to a highway: Little evidence for an association

Background There is increasing interest in obesogenic chemicals that may increase BMI in exposed individuals. Particulate air pollution appears to have obesogenic potential and ultrafine particles (UFP, <100nm) are elevated next to highways. Aims We sought to use proximity to a major highway as a surrogate for exposure to UFP and test associations with BMI for participants in the Community Assessment of Freeway Exposure and Health (CAFEH) study. Methods This analysis is based on a combined random and convenience sample of 260 adults >40 years old living in two of the study areas for CAFEH. Multi-variate regression consisted of examining the association between proximity to highway and Body Mass Index (BMI) as a continuous variable. Model-building involved consideration of many variables, including demographics, environmental exposures, illnesses and medications, physical activity and diet. Univatiate regression was conducted to determine which variables were significant with the outcome BMI. Variables that had a p-value of .05 or greater were excluded from multi-variate regression analysis. Adjusted linear regression model building was performed using a backward, forward and stepwise selection approach with a p-value of 0.15 as the entry and exit criteria. Categorical distance from the highway was included in all models. Results The Beta Estimate for proximity to highway was 0.085 and the R square value was 0.0004. Vegetable Intake, physical activity and education level were found to be significant predictors that had an expected downward effect on BMI score and a reasonable contribution to the total model variability while being born in the US showed a significant increase in BMI. Conclusions We found little of an effect of proximity to highway on BMI. However, proximity is a limited surrogate for UFP exposure and additional analysis with assigned exposures is warranted.

Abstract Number	**O-2-38-04**
Presenter	Patrick De Boever*, Inge Bos, Luc Int Panis, Romain Meeusen
Exposure	ambient air pollution
Health domains	physical activity
Type of research	others

A 12-week aerobic training program in an urban environment: effect on blood gene expression profiles and subclinical inflammatory markers

Background Exposure to particulate matter (PM) air pollution is known to contribute to inflammatory processes in humans. Aerobic exercise increases the ventilation rate, hence also the exposure to PM. Aims We investigated the impact of PM exposure during a 12-week aerobic training program on healthy volunteers by analyzing subclinical parameters at the start and at the end of the program. Methods One group (n=15) trained in an urban environment, whereas the second group (n=9) trained in a rural environment. Ultrafine Particle (UFP) concentrations were measured during each training session. Differential leukocyte counts, exhaled NO (eNO) and blood transcriptomics profiles were determined. Results Urban UFP concentrations were higher ($p = 0.003$) than in the rural environment. Leukocyte count ($p = 0.022$), neutrophil count ($p = 0.04$), and exhaled nitric oxide ($p = 0.003$) increased significantly in the urban group at the end of the program, and not in the rural group. A total of 816 genes were altered in expression (multiplicity corrected p-value<0.05 and absolute fold change > 1.5) in the urban group (399 upregulated genes, 417 downregulated genes), and 709 genes showed differential expression (665 upregulated genes, 44 downregulated genes) in the rural group. The expressions of 254 genes were altered in both groups. Gene Ontology analysis associated 55 genes to stress response. For example, an upregulation of interleukin 1 beta, superoxide dismutase and toll-like receptor 4 was observed in both groups. The analysis also revealed an interaction effect for 246 genes. Thirty nine genes were upregulated and two hundred and seven genes were downregulated when the urban group was compared to the rural group. This indicates that gene expression signals were changed depending on the location where the participants were exercising. Conclusions Our study has revealed that subclinical measurements and blood molecular patterns are significantly affected when healthy individuals exercising in an urban environment are compared to a rural environment.

Abstract Number	**O-2-38-05**
Presenter	Bettina Bringolf-Isler*, Charlotte Braun-Fahrländer, Susi Kriemler
Exposure	others
Health domains	physical activity
Type of research	cross-sectional study

Objectively assessed neighbourhood attributes associated with physical activity and sedentary behaviour in Swiss children and adolescents

Objectively assessed neighbourhood attributes associated with physical activity and sedentary behaviour in Swiss children and adolescents Background: Environmental and social neighbourhood attributes are considered important determinants of physical activity (PA) in children. So far, most studies relied on self-reported PA and perceived assessments of the built environment. Current findings mostly result from US and Australia studies limiting their applicabilty to the European setting. Aim: We aimed (1) to investigate whether the objectively assessed built and social environment was associated with PA and sedentary behaviour of Swiss children objectively measured by accelerometry and (2) whether such associations were modified by sex, age and parental education Methods: The study included 1742 Swiss children and adolescents (ages 4 to 16) with accelerometer data and a home address, which were linked to geographic information system, census data and the Swiss socioeconomic neighbourhood index. Associations between neighbourhood attributes and physical activity were analyzed by multivariable regression. Interactions were tested for age, sex and parental education. Results: The extent of green areas was the main factor being positively associated with PA ($p<0.01$). This association was particularly seen in children younger than 10 years. Factors representing centrally located urbanized areas such as population density, building density and the land use mix tended to increase PA and to reduce sedentary behaviour in children older than 10 years, in boys, and in children from less educated parents. Main street density was associated with less physical activity particularly in younger children ($p=0.09$). A higher socioeconomic neighbourhood index was associated with more PA in the total sample ($p=0.04$) Conclusions: Results support that interventions to increase childhood PA have to be context specific and need to take interactions with psychosocial factors into account.

Abstract Number	**O-2-38-06**
Presenter	Steve Hankey*, Michael Brauer, Greg Lindsey, Julian D. Marshall
Exposure	ambient air pollution
Health domains	physical activity
Type of research	health impact assessment

Neighborhood walkability and air pollution exposure

Background: Residing in high-walkability neighborhoods may be associated with health benefits (increased physical activity) and risks (exposure to traffic-related air pollution). More research is needed to characterize the overall health impacts of residence in high- and low-walkability neighborhoods. Aim: To explore how ambient air pollution in the US differs by level of neighborhood walkability. Methods: We obtained year-2010 ambient monitor data for PM2.5, NOx, and O3 for all available EPA monitors. A walkability score was assigned to each monitor from a publicly available database. We used regression analysis to estimate the relationship between ambient air pollution concentrations and walkability while controlling for city-specific background air pollution concentrations. We used cities with 5 or more monitors to estimate air pollution concentrations for midpoint walkscores in high- and low-walkability neighborhoods. We then use health risk calculations to estimate the health impacts of residence in high- and low-walkability neighborhoods (i.e., incorporating both physical [in]activity and exposure to air pollution). Results: Air pollution concentrations differed between high- and low-walkability neighborhoods, with higher concentrations in high- vs. low-walkability neighborhoods for PM2.5, (8.2 vs. 7.7 µg/m3) and NOx (24.5 vs. 13.7 ppb), and with the reverse trend for O3 (50.1 ppb in high- vs. 51.2 ppb in low-walkability neighborhoods). Conclusions: Health risks from air pollution may be important when planning for compact, walkable urban areas.

Abstract Number	**O-2-40-01**
Presenter	Sarah B. Henderson*, Stephen Rauch, Perry Hystad, Tom Kosatsky
Exposure	ionizing radiation
Health domains	cancer
Type of research	others

Differences in lung cancer mortality trends from 1986-2011 by radon risk areas in British Columbia, Canada

Background: Radon gas is a decay product of uranium. Residential exposure is associated with increased lung cancer risk, especially in smokers. Most evidence about the health effects comes from international meta-analyses, but administrative data can help public health authorities to explore local impacts. Aims: To examine and compare temporal trends in lung cancer mortality from 1986-2011 in low moderate, and high radon areas of British Columbia (BC), Canada. To illustrate differences by sex and smoking prevalence. Methods: More than 3,800 residential radon concentrations were assembled from four agencies. Eighty local health areas were classified as having low, moderate, or high radon risk based on the number of homes with concentrations greater than the Health Canada action guidelines of 200 and 600 Bq/m3. Vital statistic records were used to identify deaths due to lung cancer and due to all natural causes. The annual ratio of lung cancer mortality to all natural mortality was plotted over the study period for each radon classification. Analyses were stratified by sex and by the 2008 prevalence of current smokers. Results: The fitted ratio increased from 8% to 10% over the study period in high radon areas, and remained stable at 7.5% in the low and moderate radon areas. The high radon areas showed different patterns when stratified by sex and smoking prevalence. For males the increase was from 9% to 10%, and for females it was from 6% to 11%. For the lower smoking group the ratio increased from 6% to 9% during the first half of the study period, and then stabilized. For the higher smoking group the ratio was stable at 9% for the first half of the study period, and then it increased to 11%. Conclusions: These findings provide evidence that radon is an important risk factor for lung cancer in BC, and they suggest that the burden of disease could be reduced by targeting smokers in high radon areas. The results would be strengthened by replication, and more rigorous methods are required to assess other contributing factors.

Abstract Number	**O-2-40-02**
Presenter	Benedict Wheeler*, Gyula Kothencz, Adam Pollard
Exposure	ionizing radiation
Health domains	cancer
Type of research	cross-sectional study

Non-melanoma skin cancer geography and ecological associations with environmental risk factors in England

Background Non-melanoma skin cancers (NMSC) are very common, although rarely fatal. Widespread environmental risks for NMSC include UV radiation, for which there is good evidence, and radon and arsenic, for which evidence is weaker. Aims We investigated NMSC geography in England, and ecological associations with radon, arsenic and sunshine. Methods NMSC incidence recorded by England's eight cancer registries was mapped by local authority (n=326), along with mean household radon concentrations and long-term bright sunshine measures. Environmental arsenic distribution was estimated through digitisation of a geological map. Associations between age/sex-standardised NMSC rates and the environmental variables were investigated using fixed effects models. Results 40% of variance in NMSC rates was at registry level, after excluding one registry with anomalously low rates. There was no association between estimated environmental arsenic and NMSC rates. NMSC rates were strongly associated with bright sunshine, with a 1 hour increase in daily mean sunshine associated with an increase in NMSC rate of 32.1 per 100,000 population (95% CI 15.9, 48.3). A weak association with mean household radon concentration was observed, 0.18 per 100,000 (95% CI 0.04, 0.32) per Bq/m3, p=0.011. Conclusions Geographical variation in NMSC registration rates across England is likely to be partly explained by regional variation in registration. Under-registration leads to potential geographical bias, but this study is consistent with previous, smaller scale ecological analyses in suggesting that environmental radon may be a risk factor for NMSC. A strong association between NMSC rates and geographical sunshine variation was observed, but no association was found between NMSC and environmental arsenic estimates. NMSC has significant implications for individuals and healthcare budgets, and further research into NMSC geography and environmental risk factors is warranted.

Abstract Number	**O-2-40-03**
Presenter	Sophie Ancelet*, Olivier Laurent, David Richardson, Denis Hemon, Géraldine Ielsch, Claire Demoury, Jacqueline Clavel, Dominique Laurier
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

Bayesian prediction of childhood leukemia risks potentially due to radon, terrestrial gamma and cosmic rays in France.

Background: Previous Quantitative Risk Assessments (QRA) have suggested that natural background radiation (NBR) may be a cause of childhood leukemia but have often neglected important sources of uncertainty when radiation-related cancer risks were extrapolated from the Japanese atomic bomb survivors (LSS) to current populations. Aims: To explore the potential impacts of uncertainty in risk models, parameters and minimal latency period between exposure to NBR and the expression of risk, when predicting the excess risk of childhood leukemia in France related to 3 components of NBR: radon, cosmic rays, and terrestrial gamma rays (TGR). Methods: A Bayesian approach was used to fit 6 recently published leukemia risk models to the LSS dataset. The resulting uncertainty distributions in the risk parameters were used to derive predictive distributions of childhood leukemia excess risks due to NBR for French children (0-14 years). Results: Detailed predictions results based on the excess relative (ERR) and excess absolute (EAR) risk models proposed by the United Nations Scientific Committee on the Effects of Atomic Radiation provide a synthetic range for variation of results according to model choice. The posterior predictive medians of the percentage of cases potentially attributable to the 3 components of NBR grouped together are 20% (95% credible interval (CI): 0-68%) and 4% (95% CI: 0-11%) under these ERR and EAR risk models respectively if a 2 years latency period is assumed, 16% (95% CI: 0-66%) and 3.5% (95% CI: 0-9%) if uncertainty in the minimum latency period is addressed following recent recommendations from the US National Cancer Institute. Conclusions: A sizeable proportion of childhood leukemia might be attributable to radon, TGR and cosmic rays in France. However, the large CIs andthe different predictions provided by the 6 models show that the LSS has important limitations to help predicting leukemia due to NBR as far as populations of children are concerned.

Abstract Number	**O-2-40-04**
Presenter	Gerry Kendall*, Michael Athanson, Elliot Carter, Tim Vincent, Richard Wakeford, Mark Little
Exposure	ionizing radiation
Health domains	cancer
Type of research	exposure modeling

Estimating dose rates from naturally occurring gamma radiation in British homes

Background Exposure to ionising radiation is a well established cause of cancer and is one of the few known exogenous risk factors for childhood leukaemia. Estimates of indoor gamma ray dose rates are needed for a number of purposes, most crucially in epidemiologic studies of childhood cancer and exposure to natural background radiation. Direct measurements in the houses of interest are the most direct and reliable approach, but these are not always possible, especially when substantial numbers of residences are involved in large studies. This paper explores ways in which estimates may be made based on knowledge of gamma ray dose rates in other houses Aims To identify the optimum algorithm for estimating gamma ray dose rates in British houses using a dataset of about 10,000 measurements Methods Jackknife techniques are used to explore two general classes of interpolation model a) those based on an inverse distance weighted sum of dose rates in neighbouring houses b) those based on averages in small geographical or geologically based areas. Results The nearest neighbour models are found to be preferable to those based on small areas. The inverse distance weighting should use an exponent less than two with an exponent of -1 giving slightly better fits than alternatives. The resulting estimates have a total uncertainty of about 20%. This is dominated by inter-house variation rather than sampling error. Conclusions Reasonable estimates of indoor gamma ray dose rates can be made in houses where direct measurements are not possible by the use of an inverse distance weighted sum of measurements in neighbouring houses.

Abstract Number	**O-2-40-05**
Presenter	Hassan Alinaghizadeh*, Robert Wålinder, Martin Tondel
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

Comparing different sizes of geographical boundaries of Cs-137 deposition in relation to the total cancer incidence.

Alinaghizadeh Hassan, Tondel Martin, Wålinder RobertOccupational and Environmental Medicine, Uppsala University, Uppsala, Sweden Background: In Sweden, national estimates of cesium-137 (Cs-137) deposition from global nuclear tests and fallout from the 1986 Chernobyl nuclear accident may not accurately reflect radiation exposures to individuals. Disaggregating spatial data may improve the precision of these estimates.Aim: To determine the most valid model for estimating total cancer risk from surface average deposition of Cs-137 in three geographical units of different sizeMethods: The surface average deposition of Cs-137 at the county (largest level), municipality, and parish level (smallest level) were provided by the Swedish Radiation Safety Authority 1986. The place of residence in 1986 was determined for all 2.6 million residents in 612 parishes from 95 municipalities within 9 counties by social security numbers from the National Archives. Dates of cancer diagnosis and cancer deaths between 1986 and 2009 were determined for residents by social security numbers from the National Board of Health and Welfare. Exposure to Cs-137 was estimated for residents at each geographic level. Data were stratified by sex, and the model was adjusted for, age, Cs-137 deposition categories, duration of exposure, and random effects. Estimates on the county, municipality and parish level were analyzed separately.Results: Estimates at the parish level were lowest but had more stable confidence intervals and explained more of the variation in estimated exposures than did estimates at the other two levels. Conclusion: Estimates of total cancer incidence based on radioactive fallout were more conservative but more precise at the parish level than at the county or municipality levels. The smallest geographic subdivision appears to provide the best estimate of cancer risk from geodata of radioactive fallout.

Abstract Number	**O-2-40-06**
Presenter	Magda Bosch de Basea Gómez*, Mark Pearce, Ausrele Kesminiene, Marie-Odile Bernier, Lucian Krille, Jose Meulepas, Lara Struelens, Elisabeth Cardis
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

EPI-CT: design and epidemiological methods of an international study on cancer risks after paediatric CT

Background: Computed tomography (CT) has great clinical utility and its usage has increased dramatically over the last few decades. Serious concerns have been raised about the potential cancer risks from the associated ionising radiation doses, particularly for children, who are more radiosensitive. Given that the risk of radiation-induced cancer following low doses is estimated to be small, large collaborative international studies are required to achieve adequate statistical power to detect any increase in cancer incidence in relation to the radiation doses received through CT. Within this framework, the EPI-CT study was designed as a multinational cohort study of children and young adults who have received substantial doses of ionising radiation from CT scanning. The study aims to build-upon and expand existing cohort studies in France, UK and Germany and set-up similar cohorts in 7 European countries (Belgium, Denmark, Germany, the Netherlands, Norway, Spain and Sweden) based on a common protocol. It is coordinated by the International Agency for Research on Cancer and aims to recruit over 1 000 000 patients. Aims and Methods: To present the epidemiological protocol of the EPI-CT project and the particular challenges involved in a study of the health impact of paediatric CT and methods adopted to resolve these. Special attention will be paid to describe issues which may affect the validity of risk estimates from the study and how they are being addressed in the study. This includes missing doses from other radiological procedures, missing CTs, confounding by socioeconomic status and by indication for the CT. Progress so far: Data collection started in October 2011 and will be underway in all the countries till October 2013. At the moment about 66% of the target size of the cohort has been accrued. Acknowledgements: This work is financially supported by the EU Euratom programme (grant contract n°: 269912).

Abstract Number	**O-2-41-01**
Presenter	Jeannette Rosbach*, Machiel Vonk, Frans Duijm, Jan van Ginkel, Bert Brunekreef
Exposure	others
Health domains	other
Type of research	randomized trial

FRESH: results of an intervention experiment to improve classroom ventilation in primary schools

Background Classroom ventilation levels often do not meet rules or recommendations from governments or health organisations. Observational studies suggest that low ventilation rates influence children’s health and cognitive performance. However, few experimental studies are available to provide substantial evidence regarding this topic. Aims The FRESH study aims to investigate whether an intervention to improve indoor air quality in classrooms influences cognitive performance (reading, spelling, mathematics) and/or respiratory health (exhaled NO, FVC and FEV1) of primary school children. Therefore, an experimental study was carried out in 18 schools, of which 6 were controls. In total 435 children participated. Methods A longitudinal, experimental study was designed, with baseline measurements in all schools and a cross-over in the experimental conditions. The intervention consisted of a temporarily installed mechanical ventilation device that was designed to keep CO2 at pre-set levels (800 and 1200 ppm). Data were collected during three consecutive weeks per school during the heating seasons in 2009-2012. Results At baseline, mean CO2 concentration for all schools was 1335 ppm (SD=325). With the intervention set at 800 ppm, mean CO2 was 841 (SD=65), when set at 1200 ppm mean CO2was 975 ppm (SD=73). In the control schools, mean CO2 level was 1350 ppm (SD=486) during the 2nd and 3rd week. The average decrease in CO2 concentration after introducing the intervention was 490 ppm. Conclusion The ventilation device appeared to be able to decrease the CO2 levels in the intervention schools. Moreover, high peaks in CO2 concentration no longer occurred. However, the device was not sufficiently capable of realising the two levels of CO2 defined beforehand. At the time of the conference, results on the main outcome parameters (cognitive performance and respiratory health) will also be available.

Abstract Number	**O-2-41-02**
Presenter	Mark J Mendell*, Ekaterina Eliseeva, Molly Davies, Agnes Lobscheid, William Fisk, Michael Apte
Exposure	others
Health domains	other
Type of research	cohort study

Association of Lower Classroom Ventilation Rates with Increased Illness Absence in a Prospective Study of California Elementary Schools

Background: Limited evidence associates inadequate classroom ventilation rates (VRs) with increased illness-related absence (IRA) in students. Aims: The goal of this research was to characterize VRs in a sample of California elementary schools from three climate zones, and estimate the relationships between classroom VRs and IRA in students. Methods: We investigated relationships between VRs and IRA over two school years in 162 3rd-5th grade classrooms in 28 schools in three California school districts: South Coast (SC), Bay Area (BA), and Central Valley (CV). We estimated relationships between daily IRA and lagged VR (estimated from real-time carbon dioxide measurements) using zero-inflated negative binomial models. We also compared IRA benefits and energy costs associated with increased VRs. Results: All school districts had median VRs below the 7.1 L/sec-person California standard. For each additional 1 L/sec-person of VR (prior 7-day average), IRA was reduced significantly ($p<0.05$) in models for combined districts (-1.6%) and for SC (-1.2%), and non-significantly for districts providing less data: BA (-1.5%) and CV (-1.0%). If associations were causal and generalizable to other student ages and climatic regions in California, increasing classroom VRs from the California average to the State standard (from 4 to 7.1 L/sec-person) would decrease IRA by 3.4%, increase attendance-linked funding to schools by $33 million annually, and increase energy costs only $4 million. Increasing VRs further would provide additional benefits of reduced IRA and increased state funding to schools. Conclusions: These findings, while requiring confirmation, suggest that current classroom ventilation in California elementary schools is often inadequate per the existing standard, and that increasing classroom VRs above the State standard would substantially decrease IRA and produce economic benefits.

Abstract Number	**O-2-41-03**
Presenter	Glenn Morrison*, Daniel Oerther, Andrew Schriner, Lauren Banks, Montana Puckett
Exposure	household air pollution
Health domains	other
Type of research	exposure modeling

Window opening behavior and exposure in the U.S.

< Open windows dramatically alter occupant exposure to air pollutants of indoor and outdoor origin. However few studies have quantified the extent to which windows are open in North American residences. In this research, we use readily available data and survey instruments to understand when and how much windows are open by U.S. region. We reviewed a large set of images of residences, available from Google Streetview, to determine what fraction of these residences have windows open during the daytime (when images were collected). In addition, we surveyed 3000 randomly selected individuals across the US about window opening habits. During the 9 months of spring, summer and autumn, 20% of occupants open house windows 8 or more hours per day. Residents in the US Southeast are much more likely to keep windows closed than the rest of the country (2.8 hours vs 4.7 hours on average). Windows are more likely to be opened during the morning (28%) and afternoon (28%) than in the evening (18%). Implications: given regional differences in behavior, building construction and ambient air pollution, we anticipate significant differences in inhalation dose that may be greater than the differences in outdoor air pollution concentrations. For example, daily integrated inhalation dose of ozone in St Louis is estimated to be equal or greater than that in Atlanta, where ambient ozone concentrations trend higher. The tendency towards morning and afternoon window opening will increase relative exposure to ozone and some other photochemical oxidants. Lower window-opening frequency at night enhances exposure to indoor sourced pollutants while sleeping.

Abstract Number	**O-2-41-04**
Presenter	Pawel L. Wargocki*, Paolo Carrer, Eduardo de Oliveira Fernandes
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	review

Securing adequate indoor air quality (IAQ) across Europe: Developing the health-based ventilation guidelines (HealthVent project)

Background: Inadequate IAQ due to poor ambient air quality and indoor sources of pollution causes a loss of 2 mill. healthy life years annually in EU. Ventilation is one of many factors determining IAQ. Aims: HealthVent project was conducted to form guidelines for health-based ventilation in non-industrial buildings in Europe. Methods. Scientific literature was reviewed to examine association between ventilation and health effects both as regards ventilation rate and the type of ventilation.Risk analysis was performed to examine the impact of different strategies to control exposures and their impact on health in DALYs. Results. The data in the reviewed studies on ventilation and health were found inadequate to set the health–based ventilation rates because the studies improperly characterized exposures and because of the lack of homogeneity. Risk modelling simulations of different strategies resulting in reduction of DALYs suggested that health-based ventilation requirements should be combined with source control strategies and, if necessary, cleaning of outdoor air in order to be efficient. Consequently HealthVent proposed following guidelines. Source control is a key strategy for IAQ. Ventilation should be an ultimate measure to control exposures. WHO air quality guidelines should be used to attest no health risk. When met, the health-based reference minimum ventilation rate is to be set at 4 L/s per person to handle human bioeffluents. When not met after applying source control, ventilation rate should be a multiple of the minimum rate. Air used for ventilation must always meet WHO guidelines. Ventilation system must operate as intended without increasing health risk and must be decoupled from ventilation needed to support thermal comfort. Conclusions: Product labelling, inclusion of IAQ in ambient air quality directives and IAQ audits are among policies needed to implement the guidelines, while population-based measuring campaigns should further support them.

Abstract Number	**O-2-41-05**
Presenter	Arja Asikainen, Pawel L. Wargocki, Paolo Carrer, Otto Hänninen*
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Proposed ventilation guidelines for Europe (HealthVent-project): Projected changes in sources of exposure and resulting diseases in indoor environment

Background: Previous risk assessments conducted for European countries in the EnVIE and IAIAQ studies estimated that the burden of disease caused by inadequate indoor air quality in EU causes an annual loss of 2 million DALYs. HEALTHVENT project was launched in 2010 to quantitatively and qualitatively study the relationship between ventilation and health and to develop European health-based guidelines for ventilation. Aims: The objective of this work was to estimate the impact of proposed ventilation guideline on the sources of exposures in indoor environments and the diseases caused by them in 26 European countries. Methods: The previously developed burden of disease model was upgraded in the current work with a single compartment complete mixing mass-balance model for estimation of changes in exposures and health risks due to changes in ventilation and integrated with a model for ventilation in European countries. Results: The total reduction of burden of disease by the ventilation guideline is nearly 1 million DALYs from the current situation of 2 million DALYs. The contributions of the sources in the current situation and by the guideline (in parenthesis) are: PM outdoor 56% (61%), PM indoor 14% (22%), bioaerosols 9% (4%), radon 8% (3%), dampness 6% (5%), SHS 4% (2%), VOC 2% (3%) and CO 1% (0%). The contributions of different diseases in the baseline and by the guideline (in parenthesis) are: asthma 17% (12%), lung cancer 12% (7%), CV-diseases 62% (73%), COPD 4% (4%), acute toxication 1% (0%), U&L respiratory infections/symptoms 3% (2%) and ischaemic heart disease 2% (1%). Conclusions: The ventilation guidelines are estimated to be associated with a significant reduction in the burden of disease. Simultaneously the relative role of radon and outdoor bioaerosols are reduced and outdoor and indoor particles are increased. Relative contribution of asthma and lung cancer are reduced and cardiovascular diseases increased.

Abstract Number	**O-2-41-06**
Presenter	Otto Hänninen*, Arja Asikainen, Vitor Leal, Hugo Santos, Pawel L. Wargocki, Paolo Carrer, Matti Jantunen, Eduardo de Oliveira Fernandes
Exposure	household air pollution
Health domains	other
Type of research	health impact assessment

European Guidelines for Ventilation (HealthVent –project): Implications on Energy and Health

Background: Recent estimates show that 2 million DALYs (disability adjusted life years) are lost annually witin the EU due to poor indoor air quality. Energy performance of buildings is one of the key areas where energy consumption and climate change abatement is pressed. The current work evaluates the European ventilation guidelines proposed by the HealthVent –project by comparing the health and energy implications of the guidelines. Aim: To quantify the DALY/energy and DALY/CO2 emission ratios associated with proposed European ventilation guidelines in 26 countries. Methods: The previously developed burden of disease model (EnVIE/IAIAQ) was upgraded in the current work with a single compartment complete mixing mass-balance model for estimation of changes in exposures and health risks due to changes in ventilation. The model was used to quantify the changes in the burden of disease from the 2010 baseline due to the proposed ventilation guidelines. The ventilation guidelines are combined with an energy balance model to calculate corresponding changes in the energy needs, assuming that the guidelines would be implemented in the current building stock, and corresponding CO2 emissions accounting for the OECD reported energy balances. Results: Almost 50% of the baseline (2010) burden of disease from indoor exposures can be avoided by fully implementing the proposed ventilation guidelines, corresponding to 1 million DALYs annually. At the same time optimizing ventilation for health allows for reducing energy consumption associated with air exchange by 80%, corresponding to a 20% reduction in the total residential energy use. Conclusions: The results suggest that implementation of the proposed HealthVent ventilation guidelines almost 1 million DALYs and 0.75 PWh energy could be saved in EU26 annually.
Acknowledgement: This work was funded by the EU Health Programme project HEALTHVENT, Grant Nr. 2009 12 08.

Abstract Number	**O-2-43-01**
Presenter	Marija Živkovic*, Viša Tasic, Milena Jovaševic-Stojanovic, Renata Kovacevic, Ivan Lazovic
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

PM LEVELS IN SELECTED URBAN MICROENVIRONMENTS NEAR THE COPER SMELTER COMPLEX, BOR, SERBIA

Background: Numerous epidemiological studies have associated exposure to PM in the outdoor environment to adverse health effects. Nowadays, the attention is paid to indoor air pollution, since people spend most of time in the indoor for which there is gap of PM data. Aims: The Municipality of Bor has been the major centre for mining and processing of copper and other precious metals, assumed as hot spot with the main source of air pollution of SO2 and toxic metals and metalloids in PM. However, annual values of outdoor PM in Bor town have been reported for several years as one of the lowest in Serbia. Our study is aimed to determine the level PM in selected indoor microenvironments as hospital, kindergarten, etc. Methods: In the real-time PM10 and PM2.5 were monitored in the outdoor air with the GRIMM EDM180 while in the indoor with Turnkey OSIRIS Model 2315. For calculation calibration factors at each location during the first week of campaign a 24-h samples were collected concurrently with reference gravimetric samplers for both PM fractions. Campaigns for microenvironments were conducted in duration of 240 days covering heating and non-heating period during work-shifts days in period of 2009-2012. Results:Mean PM10 levels at Hospital and Kindergarten surpassing the EU yearly air quality standard of 40 µg/m3. The number of days that exceed the daily limit value for ambient PM10 level was calculated equal to 52% and 63% respectively. Furthermore, the measured indoor PM10 concentrations were higher than the outdoor ones at both sites. At the both microenvironment during heating period, mean daily concentrations of PM2.5 were greater than 25 µg/m3. Conclusions: Correlation coefficient between 0.33 and 0.62 show influence of outdoor to indoor PM. Mean I/O ratios were found to vary depending on the indoor activities and the outdoor concentration levels. Further research should be carried out in order to fully confirm these findings and identify sources of indoor PM.

Abstract Number	**O-2-43-02**
Presenter	Nicole Janssen*, Nick van den Hurk, Gerard Hoek, Saskia van der Zee, Moniek Zuurbier, Flemming Cassee
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Exposure to PM2.5, Black Carbon and ultrafine particles in above- and underground public transport.

Background: Several studies have shown that particulate matter (PM) concentrations in underground public transport areas such as subway stations are substantially higher compared to outdoor situations. Little is known about how these levels compare to similar above ground locations. Aims: To assess exposure to PM2.5, Black Carbon (BC) and particle number concentrations (PNC) in underground and above ground train and subway transport. Methods: Concentrations of PM2.5, BC and PNC in public transport were measured in two cities in the Netherlands (Amsterdam and Rotterdam) using real-time monitors. In each city, a 3 hour route was traveled twice for 5 non-consecutive days. Each route included at least 15 minutes measurement time in each of the following 8 site categories: underground and above ground train stations, underground and above ground subway stations, underground and above ground trains, and underground and above ground subway vehicles. Results: Concentrations of PM2.5 and BC were significantly higher in each of the four underground site categories compared to the above ground locations. The highest average BC and PM2.5 concentrations were observed in underground train stations (9 and 71 µg/m3 respectively). BC showed the largest contrasts between sites: Concentrations at underground train stations were 5 times higher compared to above ground levels, and were also 3 times higher compared to levels inside underground train and subway vehicles. Inside vehicles, strong increases and decreases in concentrations were observed when entering or exiting tunnels, and concentrations increased with increasing length of the tunnel. PNC was only significantly elevated at the underground train stations. We estimated that 2 daily 15 minutes commutes in the underground results in an extra daily exposure of 0.35 µg/m3 (3%) for PM2.5, and 0.06 µg/m3 (6%) for BC. Conclusion: We found significantly elevated levels of BC and PM2.5 in underground transport locations.

Abstract Number	**O-2-43-03**
Presenter	Anna Zimmermann*, Ming Shan, Zoe Chafe, Haixi Li, Guangqing Liu, Xudong Yang, Tao Yu, Kirk R. Smith
Exposure	ambient air pollution
Health domains	no health domain
Type of research	time series study

The contribution of household solid fuel use to ambient particulate pollution in peri-urban Beijing

Background: Considerable media attention was focused on high particulate matter (PM) concentrations measured in Beijing during January, 2013. Less well recognized is that China's peri-urban and rural populations, which rely mainly on coal and biomass for household heating and cooking, also suffer heavy outdoor pollution. Combustion of solid fuels in inefficient stoves is a significant PM source, especially outside cities. Yet, few direct ambient PM measurements are made outside cities. Thus, the contribution of household solid fuel use to ambient pollution remains poorly characterized. Aims: In this pilot study, we quantified the contribution of household solid fuel combustion to ambient PM2.5 and PM10 in a village 40 km southwest of central Beijing during June 2012 - May 2013. Methods: To characterize temporal stove use patterns over four seasons, cooking and heating devices in 33 village homes were instrumented with Stove Use Monitors (SUMs), small temperature data-loggers. Ambient PM2.5 and PM10 concentrations were measured continuously at two village rooftop sites using gravimetrically calibrated DustTrak Aerosol Monitors. Wind speed, wind direction and temperature data were collected. Time series methods were used to determine the relationship between solid fuel combustion and ambient PM patterns. Results: In winter, 97% of participating households used coal for space heating and 40% used biomass. Winter 24-hour ambient PM2.5 concentrations ranged from 260-680 µg/m3, and diurnal patterns of household solid fuel combustion and ambient PM concentrations were positively correlated. In summer, 94% of households used gas or electricity for at least one cooking task, and 34% used biomass. Summer 24-hour ambient PM2.5 concentrations ranged from 60-99 µg/m3, and significant correlations between household solid fuel use and PM levels were not detected. Conclusions: Comprehensive pollution control strategies for cities like Beijing should address household solid fuel use in surrounding areas, particularly during the winter heating season.

Abstract Number	**O-2-43-04**
Presenter	Chow Judith*, John Watson
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Multipollutant Exposure Measurements for Human Health and other Environmental Effects

The management of air quality for single pollutants with an emphasis on adverse human health effects has been effective for the development and application of emission reduction technologies. In the future, however, pollutants that are subsets of, or additions to, the standard criteria pollutants (e.g., NO2, SO2, CO, O3, PM, and Pb) should be considered, not only regarding their effects on human health, but also as they relate to odors, visibility, climate, material damage, plant and crop damage, and other ecosystem degradation. Black carbon (BC) and O3 are of particular interest owing to their direct effects on health, as well as the effects of their precursors and co-emittants. These are also short-term climate forcers and their cause damage to ecosystems and materials. Evaluating additional effects encourages the economic estimation of co-benefits, which further justifies and provides greater impetus for improving ambient air quality. There is no simple way to assess the effects of multiple pollutants in epidemiological studies. Such assessments have not been possible as most available measurements derive from fixed monitoring stations measuring single pollutants for compliance with national air quality standards. The current approach to criteria pollutant monitoring requires a separate instrument for each pollutant and a costly air conditioned shelter. Advanced microsensors hold promise for the design of more portable, less costly monitors that measure a variety of pollutants. For integrated PM filter samples, more information could be obtained on the relationship between ambient composition and effects through additional analyses beyond mass assessment. More detailed measurements of ultrafine particles and size distributions at higher time resolutions could enhance data already being generated by existing stations.

Abstract Number	**O-2-43-05**
Presenter	Elisabetta Ceretti*, Claudia Zani, Ilaria Zerbini, Gaia CV Viola, Francesco Donato, Umberto Gelatti, Rosa Maria Limina, Roberta Pedrazzani, Carla Repice, Donatella Feretti
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Air pollution exposure and DNA damage in buccal mucosa cells of pre-school children.

Background Child exposure to air pollution is a matter of concern due to the well-known health effects of air pollutants and the relevance of biological damage in childhood on the risk of developing chronic diseases in adulthood. Aim The aim of this study was to evaluate the early effects of air pollution on buccal mucosa cells of pre-school children using biomarkers of DNA damage. Methods This study was carried out on healthy 3-6-year-old children living in Brescia, a high polluted town in Northern Italy. DNA damage was investigated in buccal cells of children using the comet and micronucleus (MN) assays. Child exposure to urban air pollution was assessed by analysing PM0.5 samples collected in the school areas for polycyclic aromatic hydrocarbon (PAH) and heavy metal concentration and in vitro mutagenicity on bacteria, human leukocytes and Allium cepa cells. Data regarding other pollution sources (particularly indoor pollution) were collected using a questionnaire. Results A total of 152 children were enrolled and their biological samples were tested using the comet assay and MN tests. The results regarding the 40 subjects read so far show slightly high DNA migration (tail intensity: 6.34±5.53%; range=0.69–30.80%) and MN frequency (0.30±0.15%; range=0.09-0.99%). All PM0.5 samples show genotoxic activity in bacterial and human cells and a PAH concentration (range 5.2-6.7 ng/m3) higher than the annual law limit of 1 ng/m3. Conclusion Preliminary data concerning about a quarter of the enrolled subjects show that children living in an urban area are usually exposed to air mixtures with a high concentration of genotoxic pollutants and have slightly high DNA damage in their buccal mucosa cells. At the end of the study, all the data will be processed to investigate the associations between air pollution exposure and biomarkers of early effects. The interactions between factors will also be examined.

Abstract Number	**O-2-43-06**
Presenter	Martin Adam*, Tamara Schikowski, Anne-Elie Carsin, Cai Yutong, Margaux Sanchez, Andrea Vierkötter, Jordi Sunyer, Ursula Krämer, Nicole Probst-Hensch
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Association between long-term exposure to traffic-related air pollution and lung function: the European Study of Cohorts for Air Pollution Effects (ESCAPE)

Background. Acute air pollution effects on lung function are well established and evidence is also strong for long-term effects on lung function growth in children. The chronic impact of ambient air pollutants on lung function in adults remains poorly understood. Aims. We investigated the association of residential traffic-related air pollution with level and decline of lung function in the context of five European cohorts of adults (ECRHS, EGEA, NSHD, SALIA, SAPALDIA). Methods. Residential exposure to nitrogen oxides (NO2, NOx) and particulate matter (PM) was obtained from standardized measurement protocols and land use regression models. Traffic load at the road nearest to participants' home and on major roads within a 100 meter buffer was assessed. Study-specific analyses were performed with random effects linear regression adjusting for gender, age, height, BMI, education, smoking status. The level and annual decline in the spirometric parameters FEV1, FVC, and FEV1/FVC were considered as outcomes. Cohort-specific results were combined using random-effects meta-analysis. Results. Based on lung function data from 7,613 subjects undergoing spirometry twice over a period of 11 years on average, we observed that a 10 µg/m3 increase in NO2 exposure was associated with lower levels of FEV1 (-13.8 mL (95%CI: -25.82, -2.14)) and FVC (-14.93 mL (-28.73,-1.13)). A higher traffic load at the home address also went along with lower levels of FEV1 and FEV1/FVC. The observed associations were particularly observed in women and generally stronger in participants reporting use of respiratory medication. None of the lung function parameters was related to PM exposure. Conclusions. In this analysis of adults mostly living in urban environments, we observed a lung function decline with increased nitrogen oxide or traffic load exposure. The reported gender differences stimulate research into the underlying mechanisms.

Abstract Number	**O-2-44-01**
Presenter	Michal Krzyzanowski*, Bert Brunekreef, Richard T. Burnett, Aaron J. Cohen, Marie-Eve Héroux, Fintan Hurley, Klea Katsouyanni, Nino Kuenzli
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Methods for risk assessment to inform the revision of European policies on air quality

As a part of the review of the air quality policies, the European Union estimates the expected benefits of alternative pollution reduction scenarios. Risk assessment methods for this purpose were recommended as a part of the WHO projects: "Review of evidence on health aspects of air pollution – REVIHAAP" and "Health risks of air pollution in Europe – HRAPIE" co-sponsored by the EU. Experts convened by WHO agreed on the methods for the core cost-efficiency analysis as well as a wider set of methods for cost-benefit analysis. For particulate matter, the core method will estimate impact of long-term exposure to PM2.5 on all-natural- cause mortality. It will use a linear exposure-response function derived from a meta-analysis of all cohort studies published as of January 2013 (Hoek et al 2013, prov. accepted). A sensitivity analysis will use the approach of the Global Burden of Disease study, which predicts risk of mortality from cerebrovascular disease, IHD, COPD and lung cancer due to long-term exposure to PM2.5 (Lim et al 2012). The E-R functions applied in GBD study are supra-linear and predict decreasing marginal RRs for cardiovascular mortality with increasing exposure. For ozone, the core analysis estimates the number of premature cardiovascular and respiratory deaths associated with daily maximum 8-h ozone over 35 ppb. The risk coefficient, adjusted for PM10, is based on the APHENA study. Sensitivity analysis will include estimation of impacts of long term exposure to ozone over 35 ppb in summer on respiratory mortality. For cost-benefit analysis, estimation of impacts of short-term exposure to PM2.5 on respiratory and cardiovascular morbidity was recommended. Estimation of impacts of long- and short- term exposure to NO2 was also recommended using risk coefficients corrected for PM. Comparison of the results of various methods applied to Europe will provide assessment of sensitivity of the predictions to assumptions underlying various approaches.

Abstract Number	**O-2-44-02**
Presenter	Christer Johansson*, Lars Burman, Roger Westerholm, Annika Hanberg, Ulla Stenius, Marika Berglund, Christoffer Bergvall
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Public exposure and health impacts of changing from Swedish Class 1 diesel to European diesel in Stockholm

Background. Since 1990s the Swedish Environmental Class 1 (MK1) diesel, has dominated the Swedish market due low tax. Now European diesel (EN590) may become more important as taxation is changed. Even though, the EN590 diesel quality has improved over the years, replacement of the MK1 diesel with EN590 may lead to higher emissions of many pollutants. Aim. The objective of this project was to determine the effect on the exposure and health of the population in the metropolitan area of Stockholm of a change in diesel fuel quality of the road traffic, from MK1 to European EN 590. Methods. Population weighted annual exposures for 1.6 million residents in Stockholm were calculated using a Gaussian air quality dispersion model. Temporally and spatially resolved emissions are calculated for each hour based on a geographically resolved emission inventory. Emission factors for light and heavy duty vehicles were obtained partly from chassis dynamometer measurements and partly from a literature survey. The data included particulate matter (PM), NOx, sum of 17 PAH, benzo[a]pyrene (BaP), dibenzo[a,l]pyrene (DB(al)P). Results. Emissions of NOx, exhaust-PM, PAHs, BaP, DB(al)P, acrolein and 1,3-butadiene will increase with EN590 diesel compared to MK1 diesel. In most cases, the difference in population exposure with MK1 and EN590 diesel is small compared to the total concentrations due to all road traffic emissions; a few percent. Highest impact is seen for PM with an increase of 12% of the total local road traffic contribution when EN590 is used in 2020. With NOx as indicator of mortality due to road traffic exhaust, this will result in 15 additional premature deaths in the year 2020. The increased PAH exposure is estimated to cause 29 more cancer incidents in 2020. This is mainly due to increased DB(al)P exposure. Conclusions. Replacement of all MK1 diesel with European EN 590 is expected to have significant impact on the health of the population, with effects on both cancer incidence and cardiovascular mortality.

Abstract Number	**O-2-44-03**
Presenter	Fay Johnston*, Ivan Hanigan, Sarah B. Henderson, Geoffrey Morgan
Exposure	ambient air pollution
Health domains	policy
Type of research	time series study

Biomass smoke pollution and mortality rates in Launceston, Australia, 1994-2007: evaluation of coordinated interventions to improve ambient air quality

BACKGROUND In Launceston, Tasmania, coordinated interventions to reduce pollution from domestic wood heaters were implemented from 2001. These were associated with substantially improved winter air quality. The interventions included community education, enforcement of environmental regulations, and a wood heater replacement program. AIM To assess the effect of reductions in biomass smoke pollution on daily mortality. METHODS We assessed changes in daily all-cause, cardiovascular and respiratory mortality during the 6.5 year periods before and after June 2001 in Launceston and in Hobart, a comparable city that did not receive any air quality interventions. Age-stratified time-series analysis of daily mortality using Poisson regression models adjusted for the effects of temperature, humidity, day of week, respiratory epidemics, and secular mortality trends, were applied to Launceston and Hobart. RESULTS Mean daily wintertime PM10 fell from 42 µg/m3 during 1994-2000 to 26 µg/m3 during 2001-2007 in Launceston. The period of improved air quality was associated with small non-significant reductions in annual mortality. In males the observed reductions in annual mortality were of greater magnitude and statistically significant for all-cause (-11.4%, 95%CI -19.2 to -2.9 p=0.01), cardiovascular (-17.9%, 95% CI -30.6 to -2.8 p=0.02) and respiratory (-22.8%, 95% CI -40.6 to 0.3 p=0.05) mortality. In wintertime statistically borderline reductions in cardiovascular (-19.6%, 95%CI -36.3 to 1.5 p=0.06) and respiratory (-27.9% 95%CI -49.5 to 3.1 p=0.07) mortality were observed (males and females combined). There were no significant mortality changes in the non-intervention city of Hobart CONCLUSIONS Decreased air pollution from ambient biomass smoke was associated with reduced annual mortality in males, and with reduced cardiovascular and respiratory mortality during winter months.

Abstract Number	**O-2-44-04**
Presenter	Josef Cyrys*, Veronika Fensterer, Helmut Küchenhoff, Verena Maier, Erich Wichmann, Susanne Breitner, Alexandra Schneider, Annette Peters
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

The impact of low emission zone and heavy traffic ban in Munich on the reduction of PM10 in ambient air

Background: In Munich, Germany, a low emission zone (LEZ) and transit bans for heavy-duty vehicles have been introduced in 2008 to improve air quality and to meet policy targets. Aim: We investigated the effects of those measures on PM10 (particulate matter < 10 µm) mass concentration levels in Munich. Methods: In our analysis we compared PM10 concentrations measured prior to the implementation of any air quality measures (January 06 – January 08) with the PM10 levels measured after the measures became effective (October 08 – June 10). A semiparametric regression model with a first-order autocorrelated error term was applied for modeling hourly PM10 concentrations depending on the time of day, day of the week, the presence of the measures, background pollution, public holidays and wind direction. The changes in PM10 were quantified relative to a reference station representing regional background concentrations. Results: The mean PM10 concentration decreased at the traffic site from 30.0 µg/m3 prior to the measures to 26.0 µg/m3 thereafter, and at the background site from 27.3 µg/m3 to 25.0 µg/m3. The adjusted reduction was 13.8% at the traffic site and 4.8% at the urban background monitoring site. The effect was stronger in the summer season at the traffic site, whereas this was not observed at the background site. The effect sizes were dependent on time of day and day of the week. Conclusion: Traffic regulating measures aiming at the improvement of ambient air quality in Munich resulted in a decrease of ambient PM10 concentrations. The observed changes were larger at a traffic site than at an urban background site. The magnitude of this effect was in the range predicted by means of dispersion modeling for Munich. As dispersion modeling predicted even higher decrease of black smoke concentrations, we concluded that the introduced measures have more significant effects on human health than was anticipated when considering only the reduction of PM10 mass concentrations.

Abstract Number	**O-2-44-05**
Presenter	Patrick Ryan*, Tiina Reponen, Mark Simmons, Michael Yermakov, Chris Schaffer, Sergey Grinshpun
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

The Impact of an Anti-Idling Campaign on Ambient Air Quality Near Schools

Background: Exposure to air pollution and diesel exhaust may be elevated at schools due to nearby traffic and buses. School bus idling, in particular, has been associated with an increase of fine particulate matter (PM2.5) and elemental carbon (EC) concentrations near schools. Aims: To determine the impact of an anti-idling campaign on outdoor air quality at four schools with varying exposure to school buses. Methods: Outdoor air sampling for PM2.5 and EC was conducted at four schools for five days before and after an anti-idling campaign. Sampling began each day 30 minutes before the morning arrival of buses and concluded 30 minutes after their departure in the afternoon. Sampling was conducted simultaneously at four corresponding community sites to represent ambient background concentrations. Differences in PM2.5 and EC levels at school and community sites for each sampling day were calculated before and after the campaign. Results: Prior to the anti-idling campaign, the average concentration of PM2.5 at 3 of the 4 schools exceeded the community background levels and the difference was greatest (4.1 µg/m3, $p < 0.01$) at the school with the most buses (n = 39). The largest difference in EC between school and community site was also observed at the school with the greatest number of buses (0.40 µg/m3, $p < 0.01$). Following the anti-idling campaign, the average difference in PM2.5 at the school with the most buses decreased from 4.1 µg/m3 to 1.0 µg/m3 ($p < 0.05$). Similarly, at this school the difference in EC level decreased from 0.4 µg/m3 to 0.1 µg/m3 ($p < 0.05$). Concentrations of PM2.5 and EC at schools with fewer buses (n = 5–12) were not significantly reduced. Conclusions: The concentration of PM2.5 and EC at schools may exceed community background levels, particularly in the presence of idling school buses. An anti-idling campaign was effective at reducing the concentrations of PM2.5 and EC at the school with the greatest number of buses.

Abstract Number	**O-2-44-06**
Presenter	Adetoun Mustapha*
Exposure	ambient air pollution
Health domains	ethics
Type of research	review

Translating research findings into actions across the globe to capture the full benefits of air pollution studies (e*)

The literature has been mostly consistent about public health benefits of mitigating indoor and outdoor air pollution from industrial, traffic, housing, household and other domestic sources. Several multi-center and intervention studies notably the Global Burden of Disease (GBD) Study, have identified specific risk factors and the magnitude of burden they present to global health. The World Health Organization (WHO) has been publishing regular GBD updates for the world and 14 regions since 2000. While findings of air pollution studies such as these have driven the development and review of air quality standards in developed countries, especially in the USA and Western Europe, research findings have not always translated into actions to improve environmental health standards and policies outside the Western world. For example, PM2.5 levels are higher than WHO recommended levels in many developing countries, and about three-quarters of the population in sub-Saharan Africa is still cooking with biomass fuels, even in some of the countries that are rich in natural gas. Are there ethical issues in carrying out studies that are not translating findings into practical actions to improve public health in the population studied? Are findings from air pollution studies effectively disseminated to stimulate actions for policies and development of regions studied? Are there opportunities for environmental epidemiologists to do more common good through advocacy for consistency in the elimination of identified risk factors such as lead exposure in vulnerable groups across the globe? This presentation aims to provide opportunity for ethical dialogue among the audience to identify ways by which the global community can capture the full benefits of air pollution studies in this session's presented papers. Ways to stimulate more global action to reduce air pollution will also be discussed because air pollution does not respect national borders.

Abstract Number	**O-3-08-01**
Presenter	Jordi Sunyer*, Mar Álvarez Pedrerol, Joan Forns, Ioar Rivas, Mònica López-Vicente, Mark J Nieuwenhuijsen, Xavier Querol
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cross-sectional study

Brain and school traffic air pollution: the BREATHE Project, ecological association

Background: Health problems derived from the exposure to ultrafine particles is a major gap of knowledge, especially their effects on brain neurodevelopment. School children constitute the main risk group to UPF exposure, due to the importance of the brain development in this period but also because of their higher vulnerability and susceptibility to environmental threats. Objectives: The BREATHE project evaluates whether traffic-related air pollutants (TRAPs) may impair brain development of school children in the city of Barcelona. The aim is to asses the ecological association of TRAP levels with the cognitive performance. Methods: TRAPs were continuously measured in 39 schools, within a classroom, in the school courtyard, and in one urban background air fixed quality monitoring station at Barcelona. Two paired schools based on socioeconomic conditions were evaluated at the same time. Computer tests for working memory and sustained attention were conducted in around 3,000 children aged 7 to 9 years in the 39 schools during four times resulting in around 11,000 child-tests. Results: Working memory was negatively correlated with elemental carbon levels (EC; both indoor and outdoor) and Cu (outdoor), as well as ultrafine particle number and PM2.5 (though in a weaker way). Working memory was also negatively correlated with response rate but not with socio-economical conditions, noise, hyperactivity, inattention, or school performance. Sustained attention showed weaker negative associations with EC and Cu. Conclusions: TRAPs were correlated with cognitive performance at ecological level, which should be further evaluated using semi-individual analysis.

Abstract Number	**O-3-08-02**
Presenter	Eunjeong Kim*, HyeSook Park, Yun Chul Hong, Mina Ha, Yangho Kim, Boong-Nyun Kim, Byung-Mi Kim, Eun-Kyo Park, Eun-Hee Ha
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cohort study

Prenatal PM10 and NO2 on infant neurodevelopment at 6, 12 and 24 months of age: MOthers and Children's Environmental Health (MOCEH) study

Background and aims : There are few researches dealing with infantile neurodevelopment for prenatal exposure to air pollution. In this study, we investigated the association between prenatal PM10 and NO2 exposure and neurodevelopment in children through 24 months of age. Methods : This study is a part of MOCEH study which is an on-going, prospective birth cohort study in South Korea. Average exposure levels to PM10 and NO2 during entire pregnancy were estimated using inverse distance weighting (IDW) method. 564 mother-child pairs who completed neurodevelopmental tests more than once at ages of 6, 12 and 24 months were included in the final results. Bayley test (K-BSID-Ⅱ) was conducted to measure infantile neurodevelopment when the children became 6, 12, and 24 months of age and mental developmental index(MDI) and psychomotor developmental index(PDI) from the test were used for outcome variables. Results : In multiple linear regression model, there were significant effects of prenatal air pollution exposure on MDI (PM10: β=-0.493; p<0.001, NO2: β=-0.307; p<0.001) and PDI (PM10: β=-0.724; p<0.001, NO2: β=-0.301; p<0.001) at 6 months but not 12 and 24 months of age.GEE analysis also showed the adverse association of maternal exposure to PM10 on MDI (β=-0.283; p=0.003) and PDI (β=-0.300; p=0.002) through 24 months of age. Level of NO2 exposure was related with impairment of motor development (PDI: β=-0.130; p=0.047) but not with cognitive function. The results explain that the intensity of adverse relationship shown at 6 months might have diminished over time. Nevertheless, adverse relationship was still seen between both substances and neurodevelopmental through 24 months of age considering repeated measurement. Conclusion: Prenatal exposure to air pollution may affect infantile neurodevelopment. Therefore strategies to reduce the exposure during pregnancy are required in order to prevent risks for development in children.

Abstract Number	**O-3-08-03**
Presenter	Raanan Raz*, Andrea L Roberts, Kristen Lyall, Jaime E. Hart, Allan C. Just, Francine Laden, Alberto Ascherio, Marc G Weisskopf
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	case-control study

Exposure to Particulate Matter Air Pollution during Pregnancy Is Associated With Increased Risk for Autism Spectrum Disorder

Background: Air pollution contains many toxicants known to affect neurological function and to have effects on the fetus in utero. Several case-control studies have already found increased risk for autism spectrum disorder (ASD) with exposure to air pollutants. Particulate matter ≤2.5µm (PM2.5) and ≤10µm (PM10) have specifically been implicated in two California studies. Aims: To estimate the risk of ASD with exposure to PM2.5 and PM10 during pregnancy in a large US cohort. Methods: We identified 209 ASD cases (184 males; 25 females) and 1259 controls among children of Nurses' Health Study II participants, for whom we had residential addresses prior to pregnancy. Cases were identified by maternal report, validated with the Autism Diagnostic Interview-Revised in a subset. Residence-specific monthly PM levels were estimated from a validated spatial-temporal model. General additive logistic models with penalized splines were used to estimate odds ratios (OR) and 95% confidence intervals (CI) for ASD, adjusting for birth year, child sex, parent education, mother's age, father's age and income. Results: In the full sample, PM2.5 exposure averaged over pregnancy was associated with a linear increase in risk for ASD, with an OR of 1.39 (95% CI: 1.13-1.71) per IQR change in PM2.5 (4.13 µg/m3). Pregnancy trimester specific associations, as well as associations with exposure during time periods before or after the pregnancy, were weaker. PM10 was not associated with risk for ASD (OR=1.04 per IQR change in PM10 [7.39 µg/m3], 95% CI: 0.94-1.15). When stratified be sex, PM2.5 was associated with increased risk for ASD in males (OR=1.41, 95%CI 1.13-1.77), but not in females (OR=1.21, 95%CI 0.69-2.12). Conclusions: Our data support an association between exposure to PM2.5, but not PM10, during pregnancy and increased risk of ASD. The association may be limited to males, but the number of female cases was small.

Abstract Number	**O-3-08-04**
Presenter	Monica Guxens*, Jordi Sunyer, Raquel Garcia, Lise Giorgis-Allemand, Manolis Kogevinas, Ursula Krämer, Daniela Porta, Henning Tiemeier, Göran Pershagen, Bert Brunekreef
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cohort study

Air pollution exposure during pregnancy and childhood cognitive and psychomotor development in 6 European birth cohort studies. The ESCAPE Project.

Background: Accumulating evidence from experimental studies suggests that air pollution may have an impact on the development of the central nervous system. Aims: To assess whether air pollution exposure during pregnancy affects cognitive and psychomotor development in childhood. Methods: Collaborative study of 6 European population-based birth cohorts (GENERATION R (The Netherlands), DUISBURG (Germany), EDEN (France, 2 areas), GASPII (Italy), RHEA (Greece), and INMA (Spain, 5 areas)). Mother-child pairs were recruited from 1997 to 2008. Air pollution levels (nitrogen oxides (NO2, NOx), particulate matter with diameters of less than 2.5µm (PM2.5), less than 10µm (PM10), and 2.5-10µm (PMcoarse), and PM2.5 absorbance) at birth addresses were estimated by land-use regression models based on monitoring campaigns mostly performed between 2008 and 2011. Levels were extrapolated back in time to exact pregnancy periods using routine background monitoring network sites. General cognition, language, and psychomotor development were assessed between 1 and 6 years of age. Adjusted area-specific effect estimates were combined using random-effects meta-analysis. Results: A total of 9,482 children were included. Air pollution exposure during pregnancy was negatively associated with psychomotor development. Decreases of global psychomotor development score by 0.62 points (95% Confidence Interval -1.16; -0.09) and 1.66 points (95% Confidence Interval -3.49; 0.16) were found per each increase by 10µg/m3 in NO2 and by 5µg/m3 in PM2.5 pregnancy levels, respectively. Similar trends were observed in most areas. No association was found between air pollution exposure during pregnancy and general cognition or language development. Conclusions: Air pollution exposure during pregnancy was associated with delayed psychomotor development during childhood. Follow-up at older ages should explore catch-up and whether air pollution is related to cognitive development beyond psychomotor development.

Abstract Number	**O-3-08-05**
Presenter	Erin Haynes*, Paul Succop, Robert O. Wright, Patrick Parsons, Pierce Kuhnell, Jody Alden, Kim Dietrich
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cross-sectional study

Neurocognition of children living near a ferromanganese refinery in southeastern Ohio

Background: Airborne manganese (Mn) exposure can result in neurotoxicity and neuromotor deficits in occupationally exposed workers, yet few studies have explored chronic environmental exposure to Mn in children from industrial ambient emissions. Marietta, Ohio has the longest operating ferromanganese refinery in the United States. Aims: The goal of this study was to determine the association between Mn exposure and neuromotor performance in children. Methods: A subset of children ages 7-9 years enrolled in the Marietta Community Actively Researching Exposure Study (CARES) were invited to participate. Samples of blood and hair were collected and analyzed for Mn. Neuromotor function was assessed using the Reitan Electric Finger Tapping Task, grooved pegboard and the Bruiniks-Osteretsky Test of Motor Proficiency-2. Child intellectual function was assessed using the Weschler Intelligence Scale for Children-IV. Pearson correlations were calculated to identify key covariates. Multiple regression analyses were used to examine the relationship between internal dose markers of Mn, covariates, and confounders on neuromotor performance. Results: Neuromotor performance was evaluated on 324 children. Mean blood Mn was 10.1 µg/L (95% confidence interval (CI): 9.8, 10.5 µg/L) and mean hair Mn was 0.67 µg/g (95% CI: 0.54-0.80 µg/g). Mean residential distance from the refinery was 12.0 km (95% CI: 11.3, 12.6 km). Hair Mn was significantly correlated with child IQ ($p \leq 0.03$). We found a significant inverse relationship between ln hair Mn and finger tapping with the right hand ($p < 0.006$) and ln blood Mn and line drawing ($p = 0.04$) and copying a square ($p = 0.03$). Child age, gender, height/weight ratio, and IQ were also significant for many motor function tests. Conclusions: Exposure to airborne Mn may affect fine motor coordination in children.

Abstract Number	**O-3-08-06**
Presenter	Bruce Reed, Julian Crane, Nick Garrett, David Woods, Michael N. Bates*
Exposure	ambient air pollution
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Long-term, Ambient Hydrogen Sulfide Exposure and Cognitive Function.

BACKGROUND: Exposures to hydrogen sulfide gas (H2S), typically industrial, have been linked to a variety of negative cognitive outcomes. However, studies have generally been small and selection bias a credible explanation. AIMS: The aim was to test possible effects of chronic, low-level H2S on cognitive function using a "natural experiment" in which an urban population is chronically exposed to ambient H2S. METHODS: Participants were 1,637 adults, aged 18-65 years from Rotorua city, New Zealand, who are exposed to H2S from geothermal sources. Exposures at homes and workplaces were estimated from data collected by summer and winter H2S monitoring networks and exposure metrics were calculated for each participant based on exposures at home and work. H2S exposure was modeled both as a continuous variable and as exposure quartiles. Outcomes were neuropsychological tests measuring visual and verbal episodic memory, attention, fine motor skills, and psychomotor speed. Associations of H2S with cognition were analyzed with multiple regression, using measures of H2S exposure in models that covaried demographics and other factors known to correlate with cognitive performance. RESULTS: Findings varied somewhat depending on the exposure metric used, although the most consistent finding was of no association between H2S exposure and cognition. Quartiles of H2S exposure had a small, but statistically significant, relationship with SRT such that higher exposures were associated with faster response times. Higher exposures were associated with slightly better performanceon verbal list learning, and a verbal recall measure. Digit span performance was worst in the highest exposure quartile compared to the lowest, but the intermediate exposure quartiles had better mean scores than the lowest quartile. CONCLUSIONS: This is by far the largest study that has examined the possible long-term effects of high ambient levels of H2S. The findings provide little support for other evidence that long-term exposures to such levels of H2S are detrimental to cognitive processes.

Abstract Number	**O-3-09-02**
Presenter	Nadine Kubesch*, Audrey de Nazelle, David Martínez, Stefano Guerra, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

SUBCLINICAL RESPIRATORY AND INFLAMMATORY HEALTH EFFECTS OF TRAFFIC RELATED AIR POLLUTION AND INTERDEPENDENCIES WITH PHYSICAL ACTIVITY

Background: Short term exposure to traffic air pollution is associated with adverse respiratory outcomes. Exercise in polluted air increases pollutant uptake. Aims: The objective was to assess respiratory and systemic subclinical responses in a healthy population in Barcelona following short term exposures to traffic related air pollution and the role of moderate physical activity as a potential effect modifier. Methods: Well controlled crossover study design comparing lung function and -inflammation [Fraction of exhaled Nitric Oxide (FeNO)], and systemic inflammation markersin blood at baseline with measures repeated up to 6h post exposure to traffic related air pollution. Healthy non-smoking subjects were exposed for 2 hours to contrasting pollution levels while either cycling or resting (n=31). Each volunteer was to undergo all four conditions (high vs. low exposure; moderate physical activity vs. resting). On-site exposure monitoring included particulate matters of different sizes (UFP, PM10, PM 2.5), nitrogen oxides (NOx), and elemental carbon (EC).Data were analyzed using mixed effect models for repeated measures. Results: Physical Activity was associated with a significant increase in FEV1, (Coef. 0.034, p=0.000). These associations were robust and insensitive to adjustment for pollutants. Similarly consistent associations were seen with FeNO (Coef. 0.880, p=0.047), neutrophil percentage (Coef. 7.49%, p=0.000), and leukocytes counts (Coef. p=0.000). Interquartile increases in UFP (Coef.-0.004, p=0.001), EC (Coef.-0.004, p=0.003), NOx (Coef.-0.004, p=0.002), PM2.5 (Coef.-0.005, p=0.001), and PM10 (Coef. -0.003, p=0.002) were significantly associated with a decrease in the ratio of FEV1/FVC. Conclusions: This study suggests that moderate physical activity is slightly increasing lung function, but also lung inflammation and systemic inflammation. The decreasing ratio of FEV1 and FVC indicates a lung obstruction after traffic air pollution exposure. However, the implications of these immediate subclinical responses remain to be further explored.

Abstract Number	**O-3-09-03**
Presenter	Tamara Schikowski*, Martin Adam, Yutong Cai, Alessandro Marcon, Andrea Vierkötter, Anna Hansell, Jordi Sunyer, Francine Kauffmann, Nicole Probst-Hensch, Ursula Krämer, Nino Kuenzli
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	meta-analysis

Association between long-term exposure to traffic-related air pollution and COPD

Background: Current evidence suggests that ambient air pollution results in adverse acute respiratory effects in populations of all ages. The role of air pollution in the development of Chronic Obstructive Pulmonary Disease (COPD) remains uncertain. We aimed to assess the impact of long-term exposure to traffic related air pollution on the prevalence and incidence of COPD in four existing European cohorts (ECRHS, NSHD, SALIA, SAPALDIA) using the newly developed fully standardized ESCAPE exposure estimates. Method: Annual concentrations of NO2, NOx, PM2.5, PM10 at the home addresses were estimated using land-use regression models. GOLD stage 1+ COPD was defined as a pre-bronchodilator of FEV1/FVC<0.70 in non-asthmatics. The main regression model was adjusted for age, sex, BMI, education and smoking. Results: In total, we included 7,023 subjects with NO2 and 3,580 with PM10 exposure measures. COPD prevalence and incidence was not significantly associated with NO2 or PM10 in any of the cohorts. The associations were strongest in ECRHS (OR: 1.07 (95%CI: 0.93,1.24) and NSHD (OR: 1.17 (95%CI: 0.73,1.87)) with NO2 (per 10µg/m³) and incidence of COPD. In the meta-analyses, all markers of pollution, with exception of PM2.5, were positively but not significantly associated with COPD. The meta-analyses for COPD incidence showed an overall estimate of 1.03 (95%CI: 0.91,1.15) for a 10µg/m³ increase in NO2 and 1.08 (95%CI: 0.70, 1.65) for a 10µg/m³ increase in PM10. The effect estimates were slightly stronger in females and in non-movers. Conclusion: Our findings indicate an inconsistent association between long-term exposure to air pollution and COPD prevalence and incidence. Further investigation will be needed to address the reasons for these inconsistencies, such as the rather substantial time difference between exposure measurements taken as part of ESCAPE and the health assessment of the original studies, limitations in exposure contrasts or precision in the exposure models.

Abstract Number	**O-3-09-04**
Presenter	Kevin Lane*, Allison P Patton, Jonathan Levy, Madeleine Kangsen Scammell, Christina Fuller, John L Durant, Wig Zamore, Mkaya Mwamburi, Doug Brugge
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Association between personal exposures to traffic related ultrafine particles and biomarkers of cardiovascular health

Background: Ultrafine particles (<100 nm, UFP) are elevated near highways and major roadways and could influence cardiovascular health, but personal exposures may differ significantly from ambient concentrations. Aims: Test association of biomarkers of cardiovascular risk with annual average residential UFP levels, as well as with UFP levels adjusted for time-activity and other exposure modifying variables. Methods: We collected air pollution data using a mobile monitoring platform and built a regression model that provided residential ambient hourly UFP (estimated as particle number concentration PNC) for participants in the Community Assessment of Freeway Exposure and Health (CAFEH) study in the Boston area (N=140, a subset). We examined associations with C-reactive protein (CRP) and interleukin-6 (IL-6). We developed PNC exposure models adjusted for hourly time-activity patterns, central air conditioning, particle infiltration and window opening, and considered the influence on biomarker associations. Results: A 1% change in PNC resulted in a 1.98% change in CRP (p <0.01) and a 1.25% change in IL-6 (p <0.01). Using models that accounted for time at home resulted in a modest increase in the effect estimates (to 2.05% and 1.37%, respectively) and a decrease in the standard errors. Further adjustment for time spent in other microenvironments (school, work, highway travel and other travel) also led to increases in effect estimates and decreases in standard errors for CRP. Adjustment of PNC for time-activity led to the largest increase in effect among participants residing within 50 m of the highway, indicating potential differential exposure misclassification with respect to highway proximity. Conclusion: Annual average ambient PNC was significantly associated with CRP and IL-6. Adjusting exposure models for hourly time-activity improved associations compared to ambient residential averages, suggesting reduced exposure misclassification.

Abstract Number	**O-3-09-05**
Presenter	Jing Huang*, Furong Deng, Shaowei Wu, Henry Lu, Yu Hao, Xinbiao Guo
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

The impact of noise on the short-term effects of traffic-related air pollution on heart rate variability in young healthy adults

Background: Traffic-related air pollution and noise are associated with cardiovascular diseases, and the alternation of heart rate variability (HRV), which reflects cardiac autonomic function, is considered as one of the mechanisms. However, few studies have explored interaction effects between traffic-related air pollution and noise on HRV. Aims: We explored whether noise modified the associations between short-term exposure to traffic-related air pollution and HRV in young healthy adults. Methods: In this randomized, crossover study, 40 young healthy adults stayed for 2 hours in a traffic center, and on a separate occasion, in a park. Subjects underwent ambulatory electrocardiogram monitoring and their personal exposure to fine particle (PM2.5), black carbon (BC), carbon monoxide (CO) and noise were measured. Mixed-effects regression models were applied for analysis, and interaction effects were assessed. Results: Traffic-related air pollution and noise were negatively associated with HRV separately, and the effects of traffic-related air pollutants were amplified at high noise level (>65.6 dBA) compared with low noise level (≤65.6 dBA). Per 10 μg/m3 increment in PM2.5 (5-minute moving average) was associated with −4.61% (95% CI, −6.75% to − 2.42%) decrease in high frequency (HF) power, however the correlations became insignificant at low noise level. Per 1 μg/m3 increment in BC (1-hour average) was associated with −2.59% (95% CI, −4.43% to −0.72%) decrease in HF at high noise level, compared with −2.20% (95% CI, −3.56% to −0.81%) at low noise level. Similar effects modification was observed for CO exposure. Conclusions: Both traffic-related air pollutants and noise associated with imbalanced cardiac autonomic function. The effects of air pollutants were amplified at high noise level.

Abstract Number	**O-3-09-06**
Presenter	Timo Lanki*, Regina Hampel, Rob Beelen, Kateryna Fuks, Johanna Penell, Emmanuel Schaffner, Annette Peters
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Air pollution from road traffic and systemic inflammation

Background and Aim Exposure to particulate matter air pollution (PM) has been associated with cardiovascular diseases. The aim of this study was to evaluate whether long-term exposure to traffic-related air pollution is associated with systemic inflammation, a hypothesized biological mechanism. Methods Six adult cohorts in Central and Northern Europe were utilized for the study that was part of the large European ESCAPE study. Data on C-reactive protein (CRP) and fibrinogen, markers for systemic inflammation, were available for 22,561 and 17,428 subjects, respectively. Land use regression models were used to estimate cohort participants' long-term residential exposure to various size fractions of PM, black carbon, and nitrogen oxides (NOx). In addition, traffic intensity near residence was used to indicate exposure to traffic related pollutants. Associations between long-term exposure and inflammatory markers were analysed using linear regression models . Cohort-specific results were combined using random effects meta-analysis. Results Annual NOx concentration was associated with increased level of CRP (3.2 % increase in CRP per 20 μg/m3 increase in NOx; 95 % CI 0.3-6.1 %), but not with fibrinogen, for which the city-specific estimates were heterogeneous. Cohort participants living by a busy road had significantly higher CRP than those living in a quiet residential street (10.2 %, >10,000 vehicles/day vs. <1,000 vehicles/day; 95 % CI 2.4-18.6 %). For fibrinogen, effect estimate for traffic load on major roads within 100 m of the residence was 1.2 % (>3,000,000 vehicles/day*m vs. <500,000 vehicles/day*m; 95 % CI -0.2-2.6 %). PM2.5, PM10, and black carbon were not associated with the outcomes in the meta-analyses. ConclusionsExposure to traffic-related air pollution may increase systemic inflammation. Systemic inflammation is a known risk factor for cardiovascular diseases, and therefore the observed association with long-term exposure may partly explain the link between air pollution and incidence of cardiovascular disease.

Abstract Number	**O-3-10-01**
Presenter	Michelle L. Bell*, Antonella Zanobetti, Francesca Dominici
Exposure	ambient air pollution
Health domains	other
Type of research	meta-analysis

Evidence on Vulnerability and Susceptibility to Health Effects Associated with Short-Term Exposure to Particulate Matter: Systematic Review and Meta Analysis

Background: While there is strong evidence that particulate matter (PM) affects health, less is known about whether some sub-populations face higher risk. There is no consensus on which individual- or community-level characteristics affect PM risk estimates and to what degree (i.e., effect modification). Aims: The goal of this work is to summarize the state of scientific evidence on effect modification of health effects for short-term exposure to particulate matter. Methods: We performed a systematic review of the scientific literature on effect modification for short-term exposure to PM and performed meta-analysis for mortality associations by age and sex. Results: We identified 108 papers that directly investigate factors that might modify mortality or hospital admission risks from short-term PM exposure. Results indicate strong, consistent evidence that the elderly experience higher risks; suggestive evidence that those with lower education, income, or employment status have higher risks; and weak evidence for higher risks for women. Meta-analysis showed statistically higher effects for older populations (0.64% [0.50, 0.80%] increase in mortality per 10 µg/m3 increase in PM10) than younger populations (0.37% [0.27, 0.48%]). For women, a 10 µg/m3 increase in PM10 was associated with a 0.55% [0.41, 0.70%] increase in mortality, whereas for men this increase was 0.50% [0.34, 0.65%]. Conclusions: Evidence indicates that some populations facing larger health burdens from airborne particles. Our synthesis on modifiers for PM effects can aid design of air quality policies and suggest directions for future research. Studies of biological mechanism could be informed by evidence of differential effects by population, such as by sex and pre-existing conditions.

Abstract Number	**O-3-10-02**
Presenter	Bénédicte Jacquemin*, Xavier Basagaña, Angeliki Karanasiou, David Agis, Juan Alguacil, Julio Díaz, Xavier Querol, Jordi Sunyer, Bart Ostro, Massimo Stafoggia, Med-Particles Study Group
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-crossover study

The effects of particulate matter (PM) sources on daily hospitalizations in three spanish cities, med-particles project

Background: Many studies have reported associations between acute exposure to air pollution and hospitalizations, mainly for cardiovascular and respiratory causes. However, uncertainty remains about the specific sources that are responsible for these effects, particularly in Europe, where few studies on sources have been conducted. Also, Mediterranean cities have specific characteristics that influence air pollution composition, such as intense traffic, elevated sea emissions, intense solar radiation and high frequency of wildfires and Saharan dust episodes. This study assessed the association between various sources and daily hospitalizations in three Spanish cities within the framework of the MED-PARTICLES project. Methods: PM10 and PM2.5 concentrations were collected at regular intervals in three Spanish cities: twice a week from 2003-2010 in Barcelona, twice a week from 2007 to 2008 in Madrid and once a week from 2003 to 2010 in Huelva. Source apportionment using positive matrix factorization was developed for PM2.5. Case-crossover regression analysis was used to determine the independent effects of daily exposure to each factor on respiratory and cardiovascular hospitalization. Single-city estimates were combined using meta-analysis. Results: Three common different factors were identified for the three cities: "traffic" (interquartile range (IQR) 9.0 µg/m3), "minerals" (IQR 3.1 µg/m3) and "industrial" (only Barcelona and Huelva, IQR 1.7 µg/m3). The results indicate that traffic was associated with both respiratory (1.6% increase in hospitalizations per IQR increase, 95%CI 0.1-3.1) and cardiovascular hospitalizations at lag 3 (1.4%, 95%CI 0.0-2.4), and with respiratory hospitalization at lag 1 (1.8%, 95%CI 0.3-3.4). The results were homogeneous between the three cities (p>0.769). Conclusions: These results suggest that daily exposure to traffic contributes to the adverse health effects linked to PM2.5. Acknowledgements: MED-PARTICLES EU LIFE+ ENV/IT/327

Abstract Number	**O-3-10-03**
Presenter	Delgerzul Lodoisamba*, Hans Scheers, Benoit Nemery, Claire de Burbure, Suvd Batbaatar, Enkhjargal Altangerel, Lodoysamba Sereeter, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-crossover study

ASSESSMENT OF THE HEALTH IMPACT OF PARTICULATE MATTER CHARACTERISTICS IN, ULAANBAATAR, MONGOLIA

Background: The combination of a cold, semi-arid climate and traditional household use of biomass fuels make Ulaanbaatar, capital of Mongolia, one of the most polluted cities in the world in terms of particulate matter air pollution, especially during winter. Aims: In this study we estimated the effects of short-term exposure to PM2.5, PM10 and their chemical composition on daily morbidity in Ulaanbaatar. Methods: Mass concentration and chemical composition (33 elements) of both PM2.5 and PM10 were measured in the 9th khoroo Sukhbaatar district in Ulaanbaatar from June 2008 to June 2009. We collected data on hospital admissions for respiratory (ICD-10 J00-J99) and cardiovascular (I10-I99) disease from all hospitals in the district during the same period. We used a case-crossover design to estimate the risk of hospital admission in relation to the concentration and chemical composition of ambient PM2.5 and PM10 on the same day. Results: The average annual concentrations of PM2.5 and PM10 in the 9th khoroo Sukhbaatar district were 375.09 ± 722.59 µg/m3 (mean ± SD) and 719.36 ± 1274.32 µg/m3, respectively. During the cold season (Nov-May), the risk of hospital admission for respiratory disease (N = 2321) and cardiovascular disease (N = 822) increased by 2.0% (1.4-2.7%; p <0.001), and 1.8% (95% CI 0.7-3.0%; p <0.01), respectively, for a 100µg/m3 increase in daily mean PM2.5 concentration. For PM10, these figures were 1.1% (0.8-1.5%; p<0.001) and 1.0% (0.4-1.7%; p=0.001). No significant associations between hospital admissions and PM exposure were found during the warm period (June-Oct). Associations with chemical components of PM differed by component, between PM2.5 and PM10, and between seasons. Conclusions: Our study shows that Ulaanbaatar faces extremely high ambient levels of PM, especially during the cold period. Short-term increases in PM concentrations were associated with increases in hospital admission for respiratory and cardiovascular disease.

Abstract Number	**O-3-10-04**
Presenter	Geoffrey Morgan*, Kara Martin, Ivan Hanigan, Sarah B. Henderson, Fay Johnston
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Wood Smoke PM10 and Hospital Admissions in Seven Regional Australian Towns

Background While the toxicology and epidemiology of particulate emissions from industry and transportation is well understood the picture for wood smoke is less clear. Exposure to ambient wood smoke is associated with mortality and respiratory outcomes, with some evidence of associations with cardiovascular outcomes. The use of wood heating in regional Australian towns is common and ambient particulate exposures during winter can be high. Aims We aimed to quantify the association between hospital admissions and wood smoke derived PM10 in regional Australian towns. Methods Daily winter PM10 concentrations were available from seven towns (population range= 18,961-57,015) between 1999 and 2006 for varying periods (range= 1-8 years). We used a time-stratified case-crossover design to assess the association between winter time PM10 and hospital admissions (cardiovascular, respiratory and asthma). Odds ratios (OR) and 95% confidence intervals (CI) were estimated and models were adjusted for daily meteorology, influenza epidemics and holidays. Summary estimates for the seven towns were calculated using meta analyses for each lag and for the largest magnitude lag (maximum |z|). Results Town daily mean PM10 concentrations ranged from 15.5 to 27.2µg/m3. Meta analysis estimates found that a 10µg/m3 increase in PM10 was associated with a small magnitude increase in cardiovascular admissions (lag 2 days, OR=1.02[95%CI: 0.99 to 1.05]; lag maximum |z|, OR=1.02[95%CI: 1.00 to 1.05]), but was not associated with admissions for all respiratory conditions or asthma. Conclusions Our results add to the emerging evidence that exposure to wood smoke derived particulate is associated with cardiovascular conditions, although the relatively small populations of our seven study towns and the limited availability of PM10 exposure data means our results should be viewed with caution. Our study supports the development of policies to reduce PM10 from solid fuel combustion while maintaining access to affordable heating.

Abstract Number	**O-3-10-05**
Presenter	Amber Sinclair*, Dennis Tolsma
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

ASSOCIATIONS BETWEEN ORGANIC AEROSOLS AND ACUTE PRIMARY CARE VISITS FOR RESPIRATORY ILLNESSES

Background: As the U.S. EPA moves beyond single-pollutant risk assessment and toward the management of many pollutants, a more thorough assessment of the health impacts of all air pollutants is needed – including the less understood components of organic aerosol. Aims: To examine the effects of organic aerosols on primary care, acute respiratory visits. Methods: The time period for this analysis is Mar 21, 2006 - Jan 27, 2010. Daily acute visits for childhood and adult asthma and upper and lower respiratory infection were collected from a nonprofit managed care organization; daily air pollution measures were collected from a centrally-located air monitoring site as part of the Aerosol Research and Inhalation Epidemiology Study (ARIES) in Atlanta, GA, USA. Acute visits were defined as appointments made on the same day the visit was completed. Forty pollutants were categorized as n-Alkenes, Iso/anteiso-alkanes, Cyclohexanes, Hopanes, and PAHs. Poisson GLM was used to assess the relationships between lagged pollutants (0-2, 3-5, and 6-8 day lag averages) and acute visits, controlling for temporal trends and meteorological variables. Results: Hopanes frequently had positive associations with childhood asthma visits, with 9 of 16 significant and 2 others approaching significance for 7 to 8 day lagged pollutants. The largest significant RR (95% confidence interval) was 1.058 (1.020-1.100) for retene. Other classes of organic aerosols showed similar relationships, and a few did not have significant associations. A small number showed a negative association at 0-2 days. The relationships for adult asthma visits were similar, but none showed significant negative associations. Conclusions: There are numerous significant associations between the tested organic aerosols and acute primary care respiratory visits. These tend to occur at longer lags than those we have found in our prior work, typically day 7 or 8 lags as opposed to 3-5 day average for criteria pollutants.

Abstract Number	**O-3-10-06**
Presenter	Jessica Montresor-Lopez, Jeff Yanosky, Amir Sapkota, Xin He, James Hibbert, Robin Puett*
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

Short-term Effects of Ambient Ozone on Stroke Risk in South Carolina, USA

Background: Findings are inconsistent regarding the relationship between stroke and acute ozone exposures. Questions also remain regarding effect modification by race or gender. Objectives: We explored the association between acute ozone exposure and risk of stroke hospitalization among South Carolina (SC), USA residents and effect modification by race and gender. Methods: We conducted a case-crossover study with preliminary data on all in-state ischemic and hemorrhagic stroke hospitalizations for SC adult residents from 2002–2006. Maximum 8 hour daily ozone exposure estimates for 15 days prior to each hospitalization were assigned to each residential address based on daily gridded values from the US Environmental Protection Agency's (EPA's) Hierarchical Bayesian Model Derived Estimates. Selected periods across lagged days 0-7 prior to the hospitalization served as the case period of exposure, with analogous referent periods selected from lagged days 8-15. To estimate odds ratios and 95% confidence intervals, we utilized conditional logistic regression models. Results: There were 23,823 stroke hospitalizations with complete data, of which 52.6% were among females, 29.8% among African-Americans and 68.9% among Caucasians. The mean age was 68.6 (SD: 13.8) years. Median ozone for the case and control periods were 46.4 ppb (IQR: 39.5,52.8) and 45.8 ppb (IQR: 38.5,52.9) respectively. A 10 ppb increase in ozone exposure on the day prior to hospitalization (OR: 1.05; 95% CI, 1.03,1.07) as well as the cumulative average of 3 days prior to hospitalization (OR: 1.07; 95%CI: 1.05,1.10) was associated with increased risk of stroke hospitalization. There was no evidence of effect modification by race or gender. Conclusions: Preliminary results showed an increased risk of stroke hospitalization associated with acute ozone exposures among SC residents. Race nor gender modified the association. Further research will include exposure estimate validation and model adjustment for potential confounders that vary acutely.

Abstract Number	**O-3-11-01**
Presenter	Vreni Jean-Richard*, Jakob Zinsstag
Exposure	others
Health domains	equity
Type of research	cohort study

Crowding at Lake Chad

Background Mobile pastoralists in the Sahel zone interact very closely with their environment. The amount of rainfall affects their movements by determining pasture productivity. Parasites in the water threaten the health of the population and livestock as well as household economy which depends on milk sales and crop harvest. Although mobile pastoralists are an important economic factor for their country, little is known about their human and animal population and demography. Aims To better describe the population of mobile pastoralists and their livestock in south-eastern Lake Chad area. To test a mobile demographic surveillance system for people and their animals. To assess the prevalence of Fasciola gigantica. Methods Regular phone interviews about the human and animal population were conducted with a cohort of 20 mobile pastoralist camps and their travel routes recorded. The density of people and animals was assessed four times using random coordinates to define sampling areas Three slaughterslabs were observed for one year and all slaughtered animals examined for infection with F. gigantica. Results The mobile demographic surveillance proved to be feasible, low-cost and provided reliable real-time data. Furthermore the compliance was very high. The density of animals during the dry season exceeds up to 5 times the carrying capacities estimated for similar areas. Animals which were pastured in close proximity to the Lake Chad had a much greater risk of infection with F. gigantica. Only one animal who had not fed at the lake was infected. Geospatial analysis showed a clear pattern of higher prevalences closer to lake water. Conclusions A scaling up to a full scale mobile surveillance system is feasible and beneficial. The high animal density and access to natural resources have to be addressed on an institutional and government level, taking into account the needs of the mobile population. Livestock pastured close to Lake Chad has a great risk of infection with F. gigantica.

Abstract Number	**O-3-11-02**
Presenter	Balsam Ahmad*, Vicky Ryan, Tanja Pless-Mulloli, Wasim Maziak, Martin White
Exposure	others
Health domains	equity
Type of research	cross-sectional study

The influence of neighbourhood informality and socio-economic position on self-rated health among men and women: A multilevel cross-sectional study from Aleppo

Background There is substantial evidence that neighbourhoods have influence on health independent of individual characteristics. However, neighbourhood characteristics are rarely taken into account in the analysis of urban health studies from developing countries. Aims This study aimed to examine the influence of neighbourhood socioeconomic status (SES) and formality status on self-rated health (SRH) of adult men and women residing in formal and informal urban neighbourhoods in Aleppo, Syria. Methods: The study used data from 2038 survey respondents to the Aleppo Household Survey, 2004 (age 18–65 years, 54.8% women, response rate 86%). Respondents were nested in 45 neighbourhoods. Five individual-level SES measures, namely education, employment, car ownership, item ownership and household density, were aggregated to the level of neighbourhood. Multilevel models were used to investigate associations. Results: We did not find evidence from these data of important SRH variation between neighbourhoods. Neighbourhood average of household item ownership was associated with a greater likelihood of reporting excellent SRH in women; odds ratio for an increase of one item on average was 2.3 (95% CI 1.3-4.4 (versus poor SRH)) and 1.7 (95% CI 1.1-2.5 (versus normal SRH)), adjusted for individual characteristics and neighbourhood formality. After controlling for individual and neighbourhood SES measures, women living in informal neighbourhoods were less likely to report poor SRH than women living in formal neighbourhoods (OR= 0.4; 95% CI (0.2- 0.8) (versus poor SRH) and OR=0.5; 95% ; CI (0.3-0.9) (versus normal SRH). Conclusions: The results from this study support the evidence from high income countries that certain characteristic of neighbourhoods affect men and women in different ways. Further research from similar urban settings in developing countries is needed to understand the mechanisms by which informal neighbourhoods influence women’s health.

Abstract Number	**O-3-11-03**
Presenter	M Barton Laws*, Ellin Reisner, Kevin Stone, Tina Wang, Yeh Yating, Doug Brugge
Exposure	ambient air pollution
Health domains	equity
Type of research	cross-sectional study

Ethnicity and environmental risk perception revisited: the importance of residential location.

Background: Studies in the U.S. find that cultural or psychological characteristics are associated with perception of risk from air pollution in regional population samples. These in turn are associated with gender and ethnicity, such that white men are more tolerant of pollution than others. These studies have not assessed respondents' proximity to localized sources of pollution. Aims: To assess predictors of lay perceptions of risk from air pollution in an ethnically diverse sample in which proximity to highways, a major perceptible source of pollution, is known. Methods: We analyzed a combined area probability and convenience sample of individuals >40 in the Boston area from the Community Assessment of Freeway Exposure and Health (CAFEH) study. Variables considered here were self-reported demographics, perception of risk from air and highway pollution, support for government policy to control pollution, and scales measuring cultural and psychological characteristics. Results: Of 651 (of 704) respondents with information on relevant variables, 152 lived ≤100 m from a major highway, 310 100-400m, and 189 >1km from any highway. 46% were white, 37% Asian (mostly Chinese), 6.3% African-American, 6.3% Latino, and 7.6% other ethnicity. While white respondents, and particularly white men, were less concerned about air pollution than others, this effect disappeared when controlling for distance from the highway. In ordinal regressions controlling for age, education, gender, ethnicity and cultural value scales, distance from highway and more formal education were the only predictors of less concern about air pollution; however white (p=.03, est. .87 for 3-point ordinal scale) and male (p=.021, est. .6) respondents were less supportive than others of government policy to control pollution. Conclusions: The "white male" effect regarding risk perception may result from greater likelihood of minority respondents living near highways; but it remains regarding public policy.

Abstract Number	**O-3-11-04**
Presenter	Paul English, Jeff Fowles, Liang Guo, Galatea King, Max Richardson*, Eric Roberts, Alexa Wilkie, Craig Wolff, Michelle Wong
Exposure	pesticides
Health domains	equity
Type of research	others

Agricultural Pesticide Use Near Public Schools in California

Background California produces nearly half of all U.S.-grown fruits, nuts, and vegetables, and uses approximately ¼ of all U.S. agricultural pesticides. Children are more susceptible to pesticide toxicity compared to adults, due to differences in behavior affecting exposure, physiological development, and body size. Little is known about the types and amounts of pesticides applied near public schools in California. Aims We aimed to quantify the amounts of pesticides used in agricultural applications near schools, as well as to describe the populations attending schools with the most pesticide use nearby. Methods Quantities of pesticides of concern (carcinogens, reproductive and developmental toxicants, cholinesterase inhibitors, toxic air contaminants, fumigants, and pesticides of emerging concern) were assessed near public schools in the top 15 agricultural counties for 2010. Pesticide data were linked to highly refined field polygons and digitized boundaries of 2,858 schools to estimate use within ¼ mile of school boundaries. Results 36% of schools had pesticides applied within ¼ mile. The top four pesticides by poundage were the fumigants chloropicrin, 1,3-DCP, methyl bromide, and metam sodium. Of the top 10 pesticides identified, six are designated as "restricted materials," making them eligible for additional regulation at the county level. Eight of these top 10 had a chemical persistence of more than a week. Hispanic children were 46% more likely than White children to attend schools with pesticides of concern applied nearby. Conclusions This study found that fumigants were the most common type of pesticide applied near public schools in agricultural areas in California. These fumigants are of concern due to their neurotoxicity, genotoxicity, and drift potential. Ongoing surveillance of these compounds near schools and other potentially sensitive locations is needed in order to understand trends, usage patterns, and potential for children's exposure.

Abstract Number	**O-3-11-05**
Presenter	Liliana Cori*, Fiorella Battaglia, Fabrizio Bianchi, Benedetto Terracini
Exposure	others
Health domains	ethics
Type of research	others

Epidemiological research commissioned by public administration: ethical implications (e*)

Background Environmental epidemiology studies are increasingly funded by public bodies, the same that take decisions on prevention, reduction and remediation measures, only sometimes based on the results of studies. Sometimes they manage hazardous plants/technology. Objectives To present the core ethical implications to be assessed by researchers and Public Administration funders, and to identify the appropriate place for their management. Methods Three case-studies were examined: Sebiorec, a human biomonitoring (HBM) study funded by the Campania Region; Sebiomag, a HBM study funded by the Sicily Region; Moniter, a public health study around 8 incinerators funded by Emilia-Romagna Region. Protocols and products were reviewed and actors involved were interviewed. Results Crucial issues involving ethical implications include: ransparency of all procedures like funding, engagement regulations, recording conflicts of interest; communication of research aims, methods, potential benefits and risks, especially when the study involves the use of human specimen; use of an understandable language, in a format targeted to the specific audience; reporting of findings including recommendations; use of recommendations. A scientific board, where researcher and funders have their representative, it is not enough to avoid inappropriate overlapping of responsibilities and functions. Where an external independent review board is present, it is possible a tutoring function along the research development, to avoid interfering with the initiation, conduct, communication, publication of research. Conclusions Research planning, use and distribution of results are the most critical phases, especially when sponsors have the responsibility for funding both prevention and remediation. The mentioned issues ought to be clarified between researchers and sponsors before implementing any investigation and respected in subsequent steps. Role and responsibility of environmental epidemiology research community can be examined taking into account the ISEE Ethics Guidelines.

Abstract Number	**O-3-11-06**
Presenter	Christopher Tessum, Jason Hill, Julian D. Marshall*
Exposure	ambient air pollution
Health domains	equity
Type of research	health impact assessment

Air pollution, health, and environmental justice implications of shifting transportation fuels

Background: Vehicles are a major contributor to air pollution health effects in the United States and globally. Air pollution exposures in the U.S. are generally higher for low-socioeconomic status (SES) than for high-SES individuals.Aims: To understand health and environmental justice aspects of alternative transportation fuels. Methods: We develop and apply a spatially and temporally explicit life cycle inventory to estimate emission changes per technology. We then use a national dispersion model (WRF/Chem; 12-km scale) to estimate impacts to ambient concentrations of fine particulate matter (PM2.5) and ozone (O3). We separately estimate air pollution health impacts for white, nonwhite, high-income, and low-income individuals, for a 10% increase in vehicle-miles traveled via conventional fuel (gasoline) versus alternatives: grid-independent gasoline-electric hybrid cars, diesel cars, compressed natural gas (CNG) cars, cars fueled by ethanol from corn grain or corn stover, or battery electric vehicles powered by electricity from various fossil or non-fossil sources.Results: For scenarios with predominantly tailpipe emissions (gasoline hybrid-electric, diesel, CNG), total health impacts are reduced, but demographic aspects of exposures are unchanged (low-SES have higher exposures), relative to gasoline. For scenarios with emissions shifted up the supply chain (e.g., ethanol; vehicle electrification), health impacts are often similar to gasoline (or slightly worse), but with a demographic shift of decreasing relative impacts to low-SES individuals (i.e., helping address environmental injustice). Our research highlights the importance of considering total impacts and also distributional aspects of those impacts.Conclusions: Some of the technologies explored here would reduce total health impacts while maintaining current demographic disparities; others offer similar or slightly worse total health impacts but with reduced demographic disparities.

Abstract Number	**O-3-12-01**
Presenter	Bart Elen*, Jan Theunis, Joris Van den Bossche, Jan Peters, Bernard De Baets
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Mapping the black carbon exposure of pedestrians and cyclists in urban environments

Background The exposure to air pollution of pedestrians and cyclists in urban environments can differ significantly from street to street. Measurements from central monitoring stations are unable to describe this variability well. Mobile air quality measurements are needed, but do require the collection of huge data sets to offer a good spatiotemporal coverage. Aims Volunteers or city personnel working most of their time on the streets, can assist in collecting a huge set of exposure data at a feasible cost in targeted or opportunistic measurement campaigns. These data can be used to build a street-level exposure map with increasing level of detail and precision. To do so, user friendly measurement devices and software, privacy protection and automated data processing to update the map each time new data is collected, are required. Methods The Black Carbon Mapper (BCM) uses compact black carbon monitors, GPS and netbooks with software to transmit data and synchronize instruments. New measurements are processed by an automated data processing infrastructure. Processing steps include measurement enhancement and validation, background correction and spatiotemporal data aggregation. An interactive online air quality map is offered with the average BC exposure and summary statistics for multiple time intervals for each street section. Results A targeted case study has been conducted in the city of Ghent with volunteers biking on three routes. The BCM has also been used for a six month opportunistic measurement campaign with three teams of city guards in Antwerp. In this case processing of GPS data is more challenging. In both case studies, the differences in exposure between streets can clearly be distinguished. Conclusions The BCM has demonstrated to be a powerful platform to map the exposure of cyclists and pedestrians in urban environments. By involving city personnel and volunteers, large amounts of exposure measurements can be collected at a feasible cost when paying attention to usability, privacy and automated data processing.

Abstract Number	**O-3-12-02**
Presenter	Ian Longley*, Huimin Lin, Nick Talbot, Jennifer Salmond
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Variability in observed travel-to-school exposure to ultrafine particles

Background Commuting can disproportionately contribute to urban exposure to ultrafine particles, but the scale and causes of variability are poorly understood. This has confounded attempts to understand the epidemiological links between exposures and health effects in children, and limited our ability to formulate mitigation options which would reduce their exposure.. Aims Observe variability in travel-to-school pedestrian exposure and investigate the influence of meteorology, traffic characteristics and building topology on exposure variability. Methods Mobile measurements were conducted on realistic pedestrian routes to a school in central Auckland, New Zealand. 6 routes were chosen to represent a range of traffic exposures and were each sampled twice. Simultaneous ‘background’ measurements were also made at the school. Results 46 % of the variation of personal exposures of pedestrians were explained by variations in the background concentration. For each journey, the pedestrian/background ratio ranged from 0.27 to 22.6, with a mean of 2.2. The ratio was higher for journeys along major roads with higher variability within the route related to intermittent traffic flows between signalised intersections. Relatively higher pedestrian exposures were also associated with building aspect ratios >0.6. The pedestrian/reference ratio was generally insensitive to wind speed. A significant difference between upwind and downwind sidewalks was only found for the most heavily trafficked route. The contribution of travel-to-school to total school-day integrated exposure (concentration x time) varied from 8 % to 37 %. Conclusions Route choice was found to introduce substantial variability in pedestrian personal exposures with significant impacts on total exposure for children living in the same urban community and attending the same school. Variability was tentatively related to urban design and traffic characteristics.

Abstract Number	**O-3-12-03**
Presenter	James Woodcock, Marko Tainio*, James Chesire, Oliver O'Brien, Anna Goodman
Exposure	others
Health domains	cardiovascular disease
Type of research	health impact assessment

Modelled health impacts of the London public bike scheme

Background & Aims Bicycle sharing systems are being implemented in many cities worldwide, but have received little robust evaluation. We modelled the impacts of the London cycle hire scheme (LCH) upon the health of its users. Methods Data sources included total-population operational registration and usage data for LCH; surveys of LCH users; and London data on travel, physical activity, road traffic collisions and PM2.5 air pollution. We quantified health impacts in terms of disability-adjusted life years (DALYs), using a stochastic transport health impact simulation model (ITHIM). Route-specific PM 2.5 exposure was estimated based on a route choice model and differential ventilation rates. We investigated the contribution of parametric uncertainty to the final result and used deterministic sensitivity analysis to investigate generalisabilty. Results Over one year, 578,607 users made 7.4 million LCH trips (71% by men). These would mostly otherwise have been walked or by public transport. The age structure of the LCH population was much younger than the background population. To date there have been no fatalities on hire bikes and a trend towards fewer injuries than expected for London cycling. Using these observed injury rates, physical activity benefits substantially outweighed risks among males and among females. When we modelled injury rates as being equal to rates for all cycling in central London, however, these benefits reduced, with no significant benefit amongst women. This sex difference reflected comparatively high fatality rates for female cyclists. Results by age show the trade-off between benefits and harms improves rapidly with age for both men and women. Health changes from changes in PM 2.5 exposure were small. Conclusion LCH appears to have had positive health impacts so far. For cycling in general, however, there appears to be an excess risk of fatality for females. For middle-aged and older cyclists benefits are far clearer than for young adults. Measures should be taken that both reduce injury risk and make cycling more attractive.

Abstract Number	**O-3-12-04**
Presenter	Ting Xia*, Ying Zhang, Pushan Shah, Shona Crabb
Exposure	ambient air pollution
Health domains	physical activity
Type of research	health impact assessment

Air Quality and Health Co-Benefits from Reduced Car Travel in the Adelaide, South Australia

Background Motor vehicle emissions contribute nearly a quarter of world energy-related greenhouse gases and cause non-negligible air pollution primarily in urban areas. Reducing car use and increasing eco-friendly alternative transport, such as public and active transport, are efficient approaches to mitigate harmful environmental impacts caused by a large number of vehicles. Besides environmental benefits of promoting alternative transport, it will also produce health co-benefits`. Aims This study aimed at estimating co-benefit effects of alternative transport in Adelaide, South Australia. Method Comparative Risk Assessment methods were used to estimate the health effects of alternative urban land transport scenarios. We compared a business-as-usual 2030 projection with alternative transport scenarios—increased public transport and increased active travel. Separate models including air pollution models and health assessment models were developed to link transport scenarios with improved physical activity and air pollution reduction. Results Across the study region of approximately 1.3 million people, we noted that, by shifting short automobile trips to alternative transport, annual average urban PM2.5 would decline by approximately 0.5 µg/m3, resulting in net health benefits of 11 preventable deaths/year and 91 preventable DALYs/year because of improved air quality. Making 10% of short trips by bicycle would yield saving of 297 deaths/year because of improved physical fitness, notably from a reduction in burden of disease (DALYs) of major five chronic diseases by 35% averagely. Conclusion Although uncertainties remain, our findings suggest that significant environmental and health benefits are possible if alternative transport replaces a portion of car trips. Policies should focus on not only developing lower-emission motor vehicles but also increasing the acceptability, appeal, and safety of alternative transport.

Abstract Number	**O-3-12-05**
Presenter	David Rojas-Rueda*, Audrey de Nazelle, Oriol Teixidó, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Health impact assessment of increasing public transport and cycling use in Barcelona: A morbidity and burden of disease approach

Background: Transportation is a major source of air pollutant emissions and car use, promotes physical inactivity and sedentary lifestyle which are associated with obesity, cardiovascular disease, diabetes, cancer, and other diseases. Both physical inactivity and air pollution have been classified as two of the 20 leading risk factors of burden of disease worldwide in 2010. Aims: Quantify the health impacts on morbidity and burden of disease of reduced car trips and increased public transport and cycling trips. Methods: A health impact assessment study of morbidity of replacing short and long duration car trips with bicycle and public transport trips in the Barcelona metropolitan area (1.6 million inhabitants) was performed. Through 8 different scenarios, the number of cases of disease or injuries related with particulate matter air pollution < 2.5 mm (PM2.5), physical activity and traffic incidents in travelers was estimated. An air dispersion model was used for estimating PM2.5 exposure and cases of disease related to PM2.5 in the general population. To estimate the burden of disease in travelers and the general population of these scenarios, a disability adjusted life years (DALYs) approach was applied. Results: A 40% reduction in long-duration car trips substituted by public transport and cycling trips resulted in annual reductions of 127 cases of diabetes, 44 of cardiovascular diseases, 30 of dementia, 16 minor injuries, 11 of breast cancer and 3 of colon cancer, which resulted in a reduction of 302 DALYs per year in travelers. The reduction in PM2.5 exposure in the general population associated with the 40% reduction of long-duration car trips resulted in annual reductions of 7 cases of low birth weight, 6 of preterm birth, 1 of cardiovascular disease and 1 of lower respiratory tract infection. Conclusions: Transport policies to reduce car trips and increase public transport and cycling trips can produce important health benefits in terms of burden of disease.

Abstract Number	**O-3-12-06**
Presenter	Zorana Jovanovic Andersen*, Audrey de Nazelle, Michelle A Mendez, Ole Hertel, Anne Tjønneland, Ole Rasschou-Nielsen, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	physical activity
Type of research	cohort study

Does traffic-related air pollution in urban air modifies beneficial effects of exercise on mortality? A cohort study

Background:Physical activity benefits health and longevity. Exposure to air pollution increases the risk of premature mortality. Exercise amplifies respiratory uptake and deposition of air pollutants in the lung, and possibly amplifies harmful effects of air pollution during exercise. Aims: To examine whether health benefits of exercise outweigh the risks associated with exposure to air pollution in urban setting. Methods: 57053 subjects from Danish Diet, Cancer, and Health Cohort, living in Aarhus and Copenhagen and aged 50-65 years (1993-1997) reported data on physical activity and were followed until 2010 in Danish Cause of death registry. High exposure to air pollution were defined as the upper 25th percentile of mean levels of nitrogen dioxide (NO_2) at residential address since 1971 until event/censoring, estimated by Danish human exposure model AirGIS. We modelled the effect of biking, sports, walking, and gardening, separately on overall and cause-specific mortality by Cox regression model, and introduced dichotomized air pollution levels as an interaction term, in fully adjusted model. Results: Over 13 years, of 52061 subjects, 5534 (10.6%) died in total, 1285 (2.5%) due to cardiovascular disease, 354 (0.7%) respiratory disease (excluding lung cancer), and 122 (0.2%) diabetes as main cause. Significant protective effects of sports, biking, and gardening on overall, cardiovascular, and diabetes mortality were not modified by high air pollution levels. Protective effects of biking and gardening on respiratory mortality were annuled for subjects living in area with high air pollution (significant interaction). Conclusion: Significant benefits of exercise, biking, and gardening on overall, cardiovascular, and diabetes mortality are not moderated by high exposures to traffic-related air pollution present in urban areas, while the exercise benefits on respiratory mortality seem to be annulled for those living in areas with high air pollution.

Abstract Number	**O-3-14-01**
Presenter	Paul Elliott, Gavin Shaddick, Margaret Douglass, Kees de Hoogh, David J. Briggs, Mireille B Toledano*
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

ADULT CANCERS NEAR HIGH-VOLTAGE OVERHEAD POWER LINES

Background. Extremely-low-frequency magnetic fields are designated as possibly carcinogenic in humans, based on an epidemiologic association with childhood leukemia. Evidence for associations with adult cancers is weaker and inconsistent. Methods. We conducted a case-control study to investigate risks of adult cancers in relation to distance and extremely-low-frequency magnetic fields from high-voltage overhead-power lines using national cancer registry data in England and Wales, 1974-2008. The study included 7823 leukemia, 6781 brain/central nervous system cancers, 9153 malignant melanoma, 29,202 female breast cancer cases and 79,507 controls frequency-matched on year and region (three controls per case except for female breast cancer, one control per case) ages 15-74 years living within 1000 m of a high-voltage overhead-power line. Results. There were no clear patterns of excess risk with distance from power lines. After adjustment for confounders (age, sex [except breast cancer], deprivation, rurality), for distances closest to the power lines (0-49 m) compared with distances 600-1000 m, odds ratios (ORs) ranged from 0.82 (95% confidence interval= 0.61-1.11; 66 cases) for malignant melanoma to 1.22 (0.88-1.69) for brain/central nervous system cancer. We observed no meaningful excess risks and no trends of risk with magnetic field strength for the four cancers examined. In adjusted analyses at the highest estimated field strength, >1000 nanotesla (nT) compared with <100 nT, ORs ranged from 0.68 (0.39-1.17) for malignant melanoma to 1.08 (0.77-1.51) for female breast cancer. Conclusion. Our results do not support an epidemiologic association of adult cancers with residential magnetic fields in proximity to high-voltage overhead-power lines.

Abstract Number	**O-3-14-02**
Presenter	James Grellier*, Paolo Ravazzani, Elisabeth Cardis
Exposure	electromagnetic fields
Health domains	cancer
Type of research	health impact assessment

Potential health impacts of residential exposures to extremely low frequency magnetic fields in Europe

Background Residential exposure to extremely low frequency magnetic fields (ELF MF) has been associated with childhood leukaemia relatively consistently in epidemiological studies. Aims We aimed to estimate the cases of childhood leukaemia attributable to exposure to ELF MF in the European Union (EU27), if the association between exposure and disease seen in epidemiological studies is causal. Methods We estimated distributions of ELF MF exposure using literature review and expert elicitation. Individual distributions of exposure were integrated using a probabilistic mixture distribution approach. Exposure-response functions were estimated from the most recently published pooled analysis. Probabilistic simulation was used to estimate population attributable fractions (AFP) and attributable cases of childhood leukaemia in EU27. Results By assigning the literature review-based exposure distribution to all EU27 countries, we estimated the total annual number of cases of leukaemia attributable to ELF MF at between 32.1 (95% CIs: -13.7, 92.1) and 64.9 (95% CIs: -8.4, 517.6) depending on whether exposure-response was modelled categorically or continuously, respectively, for a no threshold effect. This corresponds to between 1.0% and 2.0% of all childhood leukaemia cases in the EU27. Conclusions Assuming that the association is causal, EMF exposure contributes relatively little to the factors potentially causing this disease. Considerable uncertainties are due to scarce data on exposure and the choice of exposure-response model, demonstrating the importance of further research into better understanding mechanisms of the potential association between ELF MF exposure and childhood leukaemia. Our study also demonstrates a need for improved monitoring of residential exposures to ELF MF in Europe.

Abstract Number	**O-3-14-03**
Presenter	Damiano Urbinello*, Anke Huss, Wout Joseph, Leen Verlock, Luc Martens, Johan Beekhuizen, Vermeulen Roel, Martin Röösli
Exposure	electromagnetic fields
Health domains	other
Type of research	exposure measurement

Assessment of radiofrequency electromagnetic field exposure levels across several European cities

Background The introduction and rapid increase of wireless telecommunication technologies as well as concerns in the general public about potential adverse health effects caused by radiofrequency electromagnetic fields (RF-EMF), led authorities to introduce precautionary exposure limits which vary considerably between cities. The impact of precautionary limits on the exposure situation of the general population is not known. Aims The objectives of this multicenter study were to compare mean exposure levels across four different European cities and to quantify the impact of such precautionary limits on RF-EMF exposure levels. Methods We performed measurements in the cities of Basel (Switzerland), Amsterdam (The Netherlands), Ghent and Brussels (Belgium) using a portable measurement device. Measurements had been conducted in typical everyday environments such as outdoor areas, public transports and indoor places between 2010 and 2012. In each area measurements were taken every 4 seconds for approximately 10 to 30 minutes. Measurements were repeated 12 times in Amsterdam, 12 times in Ghent and Brussels and 24 times in Basel. Results Arithmetic mean values for mobile phone base station exposure ranged between 0.22 V/m (Basel) and 0.41 V/m (Amsterdam) in outdoor areas, 0.11 V/m (Basel) and 0.15 V/m (Ghent and Brussels) in public transports and 0.33 V/m (Basel) to 0.37 V/m (Ghent) in indoor places. Meta-regression models indicated borderline evidence for an increase in mobile phone base station exposure in residential areas associated with increasing regulatory exposure limits but not for other type of areas. Conclusions All exposure levels were far below ICNIRP reference levels. Nevertheless, we found weak indications that exposure levels in residential areas are correlated with regulatory limits. However, an alternative explanation may be degree of urbanization or chance.

Abstract Number	**O-3-14-04**
Presenter	Johan Beekhuizen*, Manon van Eijsden, Rob T. van Strien, Hans Kromhout, Alfred Bürgi, Roel Vermeulen, Anke Huss
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure modeling

Predicting indoor electromagnetic field strengths from mobile phone base stations using 3D geospatial modelling

Background Radio frequency electromagnetic fields (RF-EMF) from mobile phone base stations can be reliably modelled for outdoor locations, using 3D radio wave propagation models that take antenna characteristics and building geometry into account. For exposure assessment in epidemiological studies, however, it is especially important to be able to reliably assess indoor exposure levels, since both adults and children spend most of their time indoors. Methods We performed 263 indoor RF-EMF 15-minute spot measurements in 101 primary schools, and in 30 private homes in Amsterdam, the Netherlands. In each location, information was collected on factors that can affect exposure to RF-EMF, namely the wall material, glazing and window frame materials. We modelled RF-EMF at the indoor measurement locations with the 3D radio wave propagation model NISMap, and compared the model predictions with the measured values to evaluate model performance. In addition, we explored if building characteristics modified the association between modelled and measured RF-EMF using linear regression. Results We found a Spearman correlation of 0.71 between the modelled and measured total downlink field strengths. The precision (standard deviation of the errors) was 0.11 V/m, with an average modelled and measured field strength of 0.094 and 0.078 V/m, respectively. The regression analysis identified wall material and glazing as significant factors, but had marginal effects on the model accuracy. Conclusions We conclude that it is feasible to reliably predict indoor RF-EMF using a 3D radio wave propagation model, when detailed information on antennas and high quality 3D-buildings are available. Information on building factors affecting indoor levels does not seem to be critical.

Abstract Number	**O-3-14-05**
Presenter	David Pettersson*, Tiit Mathiesen, Michaela Prochazka, Tommy Bergenheim, Rut Florentzson, Henrik Harder, Gunnar Nyberg, Peter Siesjö, Maria Feychting
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

Long-term Mobile Phone Use and Acoustic Neuroma Risk – Swedish Nationwide Case-Control Study

Background: There is a concern that the radiofrequency fields emitted by mobile phones could cause cancer. Epidemiological findings so far do not support an association between mobile phone use and acoustic neuroma, but the evidence concerning long term use is limited. We conducted a case-control study with the largest number of long term (≥10 years) users to date. Aims: The aim was to study: the long term effects of mobile phone use on acoustic neuroma risk, the impact of the method chosen for asking about preferred side of mobile phone use, and possible differences in the detection of acoustic neuromas between users and non-users of mobile phones. Methods: A population based case-control study was conducted in Sweden from September 2002 to August 2007. Incident acoustic neuroma cases between 20 and 69 years of age were identified in collaboration with treating clinics and from the Swedish cancer register. Controls were randomly selected from the population register, matched on age, sex and residential area. The Postal questionnaires that were used to collect exposure information were completed by 451 cases (83%) and 710 controls (65%). Results: There was no significant association between acoustic neuroma and regular use of mobile phones or with long term use (≥10 years). Decreased risk estimates for use on the same side as the tumor were seen together with increased estimates for use on the opposite side when preferred side at the time of diagnosis or later, was used. This difference was greatly reduced when side changes up to 10 years before diagnosis were considered. Odds ratios were generally lower when restricting the analyses to only histologically confirmed cases. Conclusions: The data does not imply that long term mobile phone use increases the risk of acoustic neuroma. Laterality specific risk estimates for acoustic neuroma are prone to bias from reversed causality and there are indications of differential detection of this tumor.

Abstract Number	**O-3-14-06**
Presenter	Martin Tondel*
Exposure	electromagnetic fields
Health domains	ethics
Type of research	review

Ethical aspects in assessing exposure information on electromagnetic fields in epidemiological studies (e*)

Different health outcomes after exposure to electromagnetic fields have been studied in various occupational and environmental settings. There seems to be some consistency regarding studies on exposure to extremely low frequency fields and the development of childhood leukaemia, but for radiofrequency fields there is a more lively scientific discussion as to whether cell phones and other wireless devices are a risk factor for brain tumours. Nevertheless, the International Agency for Research on Cancer has classified both extremely low frequency fields and radiofrequency fields as possibly carcinogenic to humans (group 2B). To improve quality in the study design it is important to obtain individual exposure information. In achieving individual data on exposure it is sometimes both necessary or even better to rely on information from the electric companies (voltage or distance to power lines) or mobile telephone operators (subscriber habits). However, it is essential that this information can be provided without prerequisites that can constrain the research methods, hamper publication if the results are unfavourable towards the economic interests of the companies, or perhaps question the independence of the researcher in the case of a no exposure effect being demonstrated. In more recent years, the cell phone industry has provided financial support for research on health effects. Firewalls have purportedly been implemented to assure independence in research. Universities and other sponsor organizations have claimed that these firewalls are effective and therefore researchers could claim no conflict of interest. The ethical question is if these firewalls could have achieved the goal of guaranteeing that the research is independent. Are there protocols or procedures that could be implemented that would minimize the influence of industry funders over research and thereby protect against conflict of interest? These questions will be addressed in the discussion.

Abstract Number	**O-3-15-01**
Presenter	Mary Ward*, Joanne S. Colt, Marcia Nishioka, Nicole C. Deziel, Todd P. Whitehead, Peggy Reynolds, Robert B. Gunier, Stephen Rappaport, Patricia A. Buffler, Catherine Metayer
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	case-control study

Residential Exposure to Deca-Polybrominated Diphenyl Ethers and Risk of Childhood Acute Lymphoblastic Leukemia: Effects of Adjusting for BDE209 Degradation

Background: Residential dust is a major source of polybrominated diphenyl ether (BDE) exposure. We estimated the risk of childhood acute lymphoblastic leukemia (ALL) associated with BDEs using carpet dust as an exposure indicator. Here, we compare results for DecaBDEs corrected and not corrected for BDE209 degradation during quantification. Methods: We studied 167 ALL cases 0-7 years of age and 214 birth certificate controls matched on age, sex, and race/ethnicity from the Northern California Childhood Leukemia Study in 2000-2006. We sampled carpets using a high volume surface sampler or we took dust from the home vacuum. We measured concentrations (ng/g) of 14 BDEs, including 4 DecaBDEs (206-209), using GC/MS. BDE209 standards were used to estimate degradation in the injector (temperature=290C) to BDE206-208. On a molar basis, conversion of BDE209 was 3%, 2%, and 1% to BDE206-208, respectively. Corrected and uncorrected odds ratios (ORs) were computed adjusted for demographics, sample year, and dust type. Results: BDE209 was detected in 100% of homes (corrected median (ng/g) [interquartile range]:946 [534-1682]; whereas, BDE206-208 were detected in 90, 74 and 76% of homes, respectively, and at low levels (28[15-41], 7[0.2-20], 4[0.2-10]). Correlations between corrected and uncorrected concentrations were 0.46, 0.48, 0.43, and 0.87 for BDE206-209, respectively. Correcting for BDE209 degradation and comparing the highest tertile to homes with no detections, we observed no association between BDE209 and ALL (OR=0.9, 95% CI 0.5-1.7); results were the same without correction. For BDE206, 207 and 208 corrected for BDE209 degradation, we observed significant two-fold risks with monotonic positive trends (p-trend=0.17, 0.05, 0.08, respectively). The respective uncorrected ORs were elevated but not significant (ORs=1.6, 1.8, 1.7) and there was no monotonic trend with increasing tertiles (p-trend=0.67, 0.34, 0.11). Conclusion: Correcting for estimated degradation of BDE209 resulted in stronger associations with ALL for BDE206-208.

Abstract Number	**O-3-15-02**
Presenter	Robin Dodson*, Kathryn Rodgers, Adrian Covaci, Nele Van den Eede, Alin Ionas, Alin Dirtu, Laura Perovich, Julia Brody, Ruthann Rudel
Exposure	organic compounds
Health domains	cancer
Type of research	others

Health Risks of Flame Retardants in California House Dust

Background: Higher house dust levels of polybrominated diphenyl ether (PBDE) flame retardants (FRs) have been reported in California (CA) than in other US states. Whereas PBDE exposures have been well-studied, little is known about exposures to and potential risks from other FRs. In a recent study in CA homes, we found 44 FRs, representing the broadest investigation of FRs in house dust to date. Our work suggests that manufacturers continue to use chemicals with health concerns and introduce chemicals with uncharacterized toxicity. Aims: To provide perspective on potential health risks associated with exposures to FRs in CA homes, we compare dust concentrations to available risk-based screening levels. We also explore gaps in health information and highlight areas for further research. Methods: We analyzed 2011 CA house dust samples for 49 FRs: PBDEs, Firemaster® 550, other brominated FRs, and halogenated and non-halogenated organophosphate FRs (OPFRs). We compared FR levels with EPA residential soil screening levels or screening levels derived using available cancer slope factors. Results: We detected 43 FRs. Risk-based screening levels are available for pentaBDEs, octaBDEs, hexabromobenzene, 2 chlorinated OPFRS, and 2 non-halogenated OPFRs. We derived screening levels for tris(1,3-dichloro-isopropyl)phosphate (TDCIPP) and tris(2,3-dibromopropyl)phosphate. Half of the homes had levels that exceeded at least one screening level. Levels of tris(2-chloroethyl)phosphate (TCEP) and TDCIPP, CA Proposition 65 carcinogens, and BDE 47 and BDE 99 exceeded screening levels. TCIPP levels were below a non-carcinogenic screening level; however, long-term carcinogenicity studies have not been conducted despite structural similarity to TDCIPP and TCEP. Screening levels were not available for other FRs, often because of a lack of toxicity studies. Conclusions: The continued use of FRs with established health concerns and those with limited data highlights the need to modernize US chemical policies to require more thorough testing and disclosure of chemicals prior to sale.

Abstract Number	**O-3-15-03**
Presenter	Jane Heyworth*, Lin Frtischi, Jennifer Grischik, Deborah Glass, Thomas Erren, Christobel Saunders, Bcees Study team
Exposure	others
Health domains	cancer
Type of research	case-control study

Shiftwork as a risk factor for breast cancer

Background: In 2007, the International Agency for Research on Cancer classified shiftwork involving circadian disruption as being probably carcinogenic to humans. Research into the relationship between shiftwork and breast cancer is complicated because shiftwork may comprise several aspects: light at night; phase shift; sleep disruption; lifestyle factors (diet, physical activity and alcohol intake); and low vitamin D. Aim: To determine whether breast cancer is associated with one or more aspects of shiftwork. Methods: A population-based case-control study was conducted between 2009 to 2011; 1205 breast cancer cases were recruited through the Western Australian Cancer Registry and 1789 age-matched controls from the electoral roll. For every job held for at least 6 months, women completed a questionnaire on main tasks, duration, hours/ week and weeks/ year worked, and whether the job involved night or shift work, or work at unusual hours. Women were interviewed to obtain details about the shiftwork using OccIDEAS. We stratified analyses for morningness/eveningness, flexibility/rigidity and languidness/vigorousness of circadian rhythm, and menopausal status. Results: For phase shift, we found a 22% increase in breast cancer risk (OR 1·22, 95% CI 1·01-1·47) with a statistically significant dose response relationship (p=0·04). For the other shiftwork factors, risks were marginally elevated and not statistically significant. Stratification by morningness/eveningness showed a tendency for the associations between breast cancer risk and light at night, phase shift, and sleep disruption to be higher among both neutral and morning preference women than among evening preference women. However, no interaction terms were statistically significant. No differences were observed by menopausal status. Conclusions: Phase shift (resulting from working multiple night shifts in a row) is possibly associated with breast cancer but the effect seen was not strong and needs replicating.

Abstract Number	**O-3-15-04**
Presenter	Colleen Makey, Michael McClean, Lewis Braverman, Elizabeth Pearce, Janice Weinberg, Andreas Sjodin, Thomas Webster*
Exposure	persistent organic pollutants
Health domains	other
Type of research	cohort study

Polybrominated diphenyl ethers and thyroid hormone homeostasis in a New England cohort

BACKGROUND Polybrominated diphenyl ethers (PBDEs) are a class of flame retardant chemicals that were added to many consumer products. Multiple animal studies have shown PBDEs to be thyroid hormone (TH) disruptors, leading to hypothyroidism. Epidemiologic evidence of PBDE exposure associated with TH disruption has been inconclusive. Our study is the first to use repeated measures in serum to assess the association between PBDE exposure and TH function in a North American adult cohort. METHODS From 2010-11, we collected three repeated serum samples from 52 participants in the greater Boston metropolitan area. Samples were collected at approximately 6-month intervals and analyzed for PBDE congeners and thyroid function tests. RESULTS Median sum concentrations of the five most prevalent PBDE congeners (BDE 28, 47, 99, 100, 153) by sampling round (Winter 2010, Summer 2010, Winter 2011) were 23.0 ng/g, 25.4 ng/g, and 23.3 ng/g lipid, respectively. In multivariate mixed regression models, we found that for every unit increase in BDE-100 there was a 0.05 ng/mL decrease in total T4 ($p < 0.05$). Total T4 was also observed to be inversely associated with BDEs 47 and 99, but not statistically significant. DISCUSSION These results are consistent with the animal studies showing exposure to PBDEs is associated with a decrease in T4. The most likely mechanism of action based on toxicological studies is a decrease in serum T4 binding, leading to decreases in total T4. Since the free T4, total T3, and TSH concentration were unchanged, it is unlikely that BDE's affected the pituitary/thyroid axis in this study. Our results are inconsistent with several larger cross-sectional epidemiologic studies that have shown PBDE exposure to be associated with decreases in TSH or increases in T4 or T3.

Abstract Number	**O-3-15-05**
Presenter	Glenys Webster*, Stephen Rauch, Andre Mattman, Bruce Lanphear, Scott A. Venners
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Perfluoroalkyl acids (PFASs) and thyroid disruption in US adults (NHANES 2007-2008)

Background: Perfluoroalkyl acids (PFASs) are known thyroid toxicants in animal studies, but the effect of PFASs on human thyroid hormones is unclear. Aims: To examine PFAS-thyroid hormone associations in a representative, population-based sample of US adults. We hypothesized that people who had undiagnosed autoimmune hypothyroidism, defined as thyroid peroxidase antibody (TPOAb) >9 IU/mL, and low iodine status would be susceptible to PFAS-induced thyroid disruption because of their compromised capacity to regulate thyroid hormone production. Methods: Our sample included 1,525 US adults (≥18 years) from the 2007-2008 NHANES study with available serum PFAS and thyroid hormone data, excluding those with a previously-diagnosed thyroid condition and those taking thyroid medications. We evaluated associations between individual serum PFASs (PFHxS, PFNA, PFOA and PFOS), and thyroid hormones (fT4, fT3, fT3/fT4, and TSH) using multivariable linear regression. Models were stratified by TPOAb status (high: ≥ 9 IU/mL serum, normal < 9 IU/mL), and iodine status (normal: > 100 µg/L urine, low: ≤ 100 µg/L iodine urine), and were adjusted for age, sex, urinary cotinine, race/ethnicity, time of day of serum collection, and, for women, pregnancy and menopause status. Results: Median serum PFAS concentrations, in ng/g, were: 1.9 (PFHxS), 1.5 (PFNA), 4.3 (PFOA) and 13.9 (PFOS). 426 (28%) of participants had low iodine status, 113 (7%) had high TPOAb, and 26 (2%) had both low iodine and high TPOAb. Higher concentrations of all four PFASs were significantly associated (α=0.05) with lower fT4, higher fT3 (PFOS and PFOA only), higher fT3/fT4, and higher TSH in the low iodine / high TPOAb group only. A weak positive association between PFOA and TSH was also found in participants who had low iodine but normal TPOAb. Conclusions: Exposures to PFASs are associated with hypothyroid disruption in adults who have both low iodine and undiagnosed autoimmune hypothyroidism, a population representing about 2.2% (5 million) of US adults.

Abstract Number	**O-3-15-06**
Presenter	Paul J Villeneuve*, Michael Jerrett, Darren Brenner, Jason Su, Hong Chen, John McLaughlin
Exposure	organic compounds
Health domains	cancer
Type of research	case-control study

Long-term exposure to ambient volatile organic compounds and lung cancer in a case-control study in Toronto, Canada

Background: Many volatile organic compounds (VOCs) are recognized human carcinogens. Few studies have examined associations between lung cancer and ambient concentrations of volatile organic compounds in urban areas. Aims: We investigated the relationship between long-term exposure to NO2, benzene, and total hydrocarbons derived using land-use regression models and lung cancer among participants of a case-control study in Toronto, Canada. Methods: The study consisted of 445 incident lung cancer cases and 948 controls in Toronto, Canada who completed questionnaires between 1998 and 2002. Individual-level risk factor data that were collected included: smoking habits, exposure to second hand cigarette smoke, body mass index, and family history of cancer. Land-use regression estimates of benzene, total hydrocarbons, and nitrogen dioxide (NO2) were derived from mass sampling campaigns conducted in 2004 and 2008. Logistic regression was used to estimate adjusted odds ratios and their 95% confidence intervals in relation to an interquartile range increase in each pollutant. Results: An interquartile range increase in the time-weighted average benzene concentration (0.16 µg/m3) across past residences was positively associated with lung cancer (odds ratio(OR)=1.41, 95% CI=1.08, 1.83). Similarly, an increase in the interquartile range of the time-weighted average of NO2 was also associated with lung cancer (OR=1.28, 95% CI=1.04, 1.58). Multi-pollutant models were unable to discern which pollutant was most strongly related to lung cancer. The risk estimates were largely unchanged after adjusting for cigarette smoking, environmental tobacco smoke, and socio-demographic characteristics. Effects were slightly stronger after restricting analyses to population based controls only (i.e., after excluding the hospital control series). Conclusions: These analyses suggest that long-term exposure to ambient benzene and NO2 at relatively low concentrations may contribute to lung cancer.

Abstract Number	**O-3-16-01**
Presenter	Markey Johnson*, Jue Yi (Joyce) Zhang, Liu Sun, Olesya Elikan, Stefania Bertazzon
Exposure	metals
Health domains	no health domain
Type of research	cohort study

Land-Use Regression Models for Metals Associated with Airborne Particulate Matter in Calgary, Alberta

Background: Fine airborne particulate matter has been associated with cardiovascular and respiratory morbidity and mortality, and there is evidence that metals may contribute to these adverse health effects. We developed seasonal land-use regression (LUR) models to characterize the spatial distribution of PM-associated metals in Calgary, Alberta. Previous studies have successfully modeled PM and gaseous pollutants; however, to our knowledge this is the first study to develop LUR models for metals. Methods: Particulate matter with <1.0 µm in aerodynamic diameter (PM1.0) was measured at 25 sites during 2-week periods in August 2010 and January 2011. PM1.0 filters were analyzed using inductively-coupled plasma mass spectrometry. Industrial sources were obtained through the National Pollutant Release Inventory and verified using Google Maps. Traffic and zoning data were obtained from the City of Calgary. Predictor variables were generated using ArcMap-10.1. LUR models for arsenic, chromium, copper, lead, manganese, mercury, nickel, vanadium, and zinc were developed using SAS-EG-4.2. Results: Preliminary summer models explained 60-90% of the variability in arsenic, chromium, copper, lead, manganese, mercury, nickel, vanadium, and zinc, while winter models explained 40-80% of the variability in metals concentrations. Industrial sources and industrial land-use zoning were the strongest predictors ($p<0.05$). However, traffic was not a major predictor for most metals. These findings contrast with LUR models for PM and gaseous pollutants in which traffic variables were highly influential. There was an average improvement of 5-10% in model efficacy when wind speed and direction were included. Conclusions: These results suggest that airborne metals vary spatially with the distribution of local industrial sources and that LUR modeling can be used to predict local metals concentrations. Future analyses will include LUR modeling of the remaining PM-components.

Abstract Number	**O-3-16-02**
Presenter	Paloma Beamer*, Anastasia Sugeng, Nathan Lothrop, Melissa Cox, Walter Klimecki, Sarah T. Wilkinson, Miranda Loh
Exposure	metals
Health domains	no health domain
Type of research	exposure measurement

Airborne metal concentrations measured using passive samplers in a community near contaminated mine tailings

Background: Many communities are located near contaminated mine tailings and smelter ash. Multiple air samples are necessary to assess the extent of exposures and factors contributing to exposures in these communities. However, air sampling equipment is not only costly, it requires trained personnel to obtain the measurements, limiting the number of samples that can be collected. Passive samplers may be a simple low-cost method that could complement active air sampling efforts. Aims: The objective of our study was to use passive samplers to characterize the potential for exposures from aeolian resuspension in a community near contaminated mine tailings. Methods: We placed 120 mm diameter filters in stainless steel cylinders (h=191 mm) for at least 7 days in 18 houses in northern Arizona. The filters were analyzed for metals by ICP-MS following microwave-assisted nitric acid digestion. We estimated air concentrations for each metal using a flow rate previously calculated for the passive samplers. Results: The mean (sd) air concentration was 9.4x10-4 (9.0 x10-4) and 2.9x10-3 (3.0x10-3) µg/m3 for arsenic and lead, respectively. Previous active ambient air monitoring by the US EPA had measured mean air concentrations of 1.8x10-3 and 3.1x10-3 µg/m3 for arsenic and lead, respectively. Our results indicate that air concentrations continue to be above US EPA residential regional screening level of 5.7x10-4 µg/m3. There was no association between air concentration and distance to the contaminated site. However, the site and the closest homes are located in a valley and many of the farther homes are at higher elevations up-slope from the site. More work is needed to understand the distance and direction traveled by the contaminated mine tailings during aeolian resuspension and the spatial distribution of these contaminants. Conclusions: Our results indicate the passive air samplers may be a simple low-cost method to assess potential exposures near contaminated sites.

Abstract Number	**O-3-16-03**
Presenter	Jun Bi*, Zongwei Ma, Kai Chen, Lei Huang
Exposure	metals
Health domains	other
Type of research	exposure measurement

Heavy metal contamination identification and health risk assessment in the mining areas of Western Suzhou, China

Background: Heavy metal (HM) pollution due to mining activities is becoming a major environmental problem in China. Suzhou is one of the most developed cities in East China. There is a closed Pb-Zn-Ag mine (A1) that had been excavated for tens of years before it was closed approximate ten years ago in Western Suzhou. And there is mineral concentration plant (A2) and a newly opened mine (A3) in Western Suzhou. Few studies have concerned about HM pollution problems in Western Suzhou. Aims: The present work is to identify the HM contaminant sites and assess the health risk due to the mining activities in Western Suzhou. Methods: Soil, road dust, tap water, ground water, air, and food samples were collected from Western Suzhou. HM concentrations (including Cu, Zn, Pb, Cd, Hg, Cr, and Ni) in the samples were analyzed. The index of geo-accumulation (Igeo) was used for contamination evaluation. USEPA recommended methods were applied for health risk assessment. Geo-statistic methods were used for spatial analysis of HM pollutions and health risks. Results: Tap water, ground water, and air environments were basically uncontaminated by HMs in Western Suzhou. Spatial analysis shows that soils and road dust in area A1 and A2 were heavily polluted by HMs, followed by the A3 area. Other areas away from the mining activities were the least polluted. Zn, Pb, Cd, and As were the most polluted metals and mainly from the mining activities. Cr and Ni were considered to be uncontaminated. Vegetables grown in mining area have higher HM concentrations than those grown in non-mining areas. Health risk assessment shows that soils, road dust, and vegetables in A1 and A2 areas have posted high carcinogenic and non-carcinogenic risk to local residents. Health risks in A3 area are much lower because it is newly opened, but still higher than those non-mining areas. Conclusions: A1 and A2 were identified as contaminant sites and rigid control and management measures for HM pollutions are urgently needed in mining areas in Western Suzhou.

Abstract Number	**O-3-16-04**
Presenter	Roxanne Karimi, Susan Silbernagel, Rebecca Monastero, Keith Levine, Jaymie Meliker*
Exposure	metals
Health domains	no health domain
Type of research	exposure measurement

Elevated Blood Mercury Levels in Adult Avid Seafood Consumers

Background: Mercury (Hg) is a known neurotoxicant but risk at low levels of exposure is uncertain, particularly among the adult population. The most common source of exposure is in the form of methylmercury from predatory fish. Debate, spearheaded by the fishing industry, continues to surround the influence of seafood consumption on elevated blood mercury levels and related effects. Aims: Investigate prevalence of elevated Hg exposure among adult avid seafood consumers, and how that relates to seafood consumption patterns to inform risk communication efforts. Methods: The cohort of seafood consumers (N=290) was recruited from the coastal population of Long Island, New York. Participants completed a detailed food frequency questionnaire and provided blood which was analyzed for Hg at the RTI Trace Inorganics Laboratory and omega-3 fatty acids at the Guelph Lipid Analytics Laboratory. Statistical analyses included hierarchical cluster analysis to group fish consumers, and linear regression to quantify associations between consumption patterns, Hg, and omega-3 fatty acids. Results: In total, 41% of the participants had blood Hg above the reference dose (RfD=5.8 µg/L), with 90th %ile =17.8 µg/L, max=51.0 µg/L, and geometric mean=4.42 µg/L. Among females of child bearing age, 28% were above the RfD. The dominant fish types consumed were salmon, tuna, and shrimp; 45% ate salmon, shrimp, and tuna, each, at least 2-3 times/month. Consumers also ate many other types of seafood at lower frequency. In regression analyses adjusted for different types of seafood consumption, mercury was associated with weekly tuna steak intake, and monthly swordfish intake. Omega-3s were associated with weekly salmon intake. Conclusions: These findings identify an at-risk population of avid seafood consumers that could benefit from information on how to enjoy seafood while making low-mercury seafood choices. Future work will shed light on risks and benefits among avid seafood consumers.

Abstract Number	**O-3-16-05**
Presenter	Dingsheng Li, Gunnar Johanson, Claude Emond, Ulrika Carlander, Olivier Jolliet*
Exposure	metals
Health domains	respiratory disease
Type of research	exposure modeling

Physiologically Based Pharmacokinetic Modeling of Cerium Oxide Nanoparticles in Rats

Background: Though the use of engineered nanoparticles (NPs) has increased exponentially, little attention has been given to NP bioavailability and biodistribution. Cerium oxide (CeO2) NPs have been used as a fuel additive, meanwhile in vitro studies have reported the cytotoxic effects of CeO2 NPs. Therefore, determining the biodistribution of CeO2 NPs is needed. Aim: The aim of this study was to develop a physiologically based pharmacokinetic (PBPK) model to explore the biodistribution of intratracheally instilled CeO2 NPs in rats in order to advance the understanding of NPs behavior in the body. Methods: The model consists of 10 compartments (blood, lungs, gastrointestinal tract, liver, kidney, lungs, heart, brain, spleen and rest of the body) interconnected via the blood circulation. Each compartment has a sub-compartment of phagocytizing cells (PCs) which may phagocytize NPs in a saturable manner. All PCs are assumed to behave in the same way, only the number of PCs differs between organs. Parameters of the model were either taken from literature or fitted for experimental data collected on 6.6 nm CeO2 NPs over 28 days from another study. Results: The simulated time courses of NP tissue distribution agreed well with experimental data, yielding an R2 of 0.98. According to the model, 43.5% of the instilled NPs were captured by the PCs in the alveolar region within 6 hours; 20.5% of the NPs were transferred from the pulmonary region to the gastrointestinal tract and excreted in the feces within 72 hours. NPs initially deposited in the alveolar region slowly penetrated the alveolar wall,entered the blood circulation and and accumulated in the liver and spleen. Conclusions: The model successfully predicted the biodistribution of intratracheally instilled CeO2 NPs in rats. Further investigations are ongoing to study the sensitivity of the model parameters and to support the most critical parameters with additional experimental data.

Abstract Number	**O-3-16-06**
Presenter	Gerald Bachler*, Natalie von Götz, Konrad Hungerbühler
Exposure	metals
Health domains	no health domain
Type of research	exposure modeling

Development of a PBPK Model for Ionic and Nanoparticulate Silver

Owing to its broad-spectrum antibiotic properties silver as bulk or nanosilver is increasingly incorporated in consumer products. At the moment nanosilver by number of products is the most common nanomaterial found in consumer products (Woodrow Wilson Database). Hence, due to the wide usage of ionic silver and nanosilver, total consumer exposure to (nano)silver may be substantial. Potential exposure routes include dermal uptake (e.g. clothes), inhalation (e.g. sprays) and ingestion (e.g. food boxes). Our project aims at comparing exposure to silver by exposure route and by form (ionic silver versus nanosilver). To this end, two physiologically based pharmacokinetic (PBPK) models were developed, one for ionic silver and one for nanosilver. Both models were designed to simulate the silver mass flow within the human body, including (nano)silver absorption via different exposure routes, and subsequent distribution, metabolism and excretion. The distribution of ionic silver was based on the mercapto pathway, whereas the distribution of nanosilver was modeled according to the potential of nanoparticles to pass the capillary wall of the organs or to be phagocytosed in the mononuclear phagocyte system (MPS). Distribution, metabolism and excretion parameters were calibrated using in-vivo data of organ silver levels in rats and were then extrapolated to humans. Both PBPK models were extensively validated with external in-vivo and biomonitoring data, which also helped us to gain more insight into the toxicokinetics of ionic silver and nanosilver. The results of our model indicate e.g. (1) that the size and coating have a minor influence on the biodistribution of nanosilver and (2) that nanoparticles are directly stored as insoluble salt particles. Furthermore, we used our PBPK models to evaluate and compare organ silver levels in the human body, caused by various (nano)silver containing consumer products. The Project is funded by the Swiss Federal Office of Public Health (FOPH).

Abstract Number	**O-3-17-01**
Presenter	Yuexia Sun, Malin Larsson, Kiril Naydenov, Geo Clausen, Nai-Yun Hsu, Zuraimi Sultan, Chungyoon Chun, Yinping Zhang, Carl-Gustaf Bornehag, Jan Sundell*
Exposure	household air pollution
Health domains	allergies
Type of research	cross-sectional study

Global Picture on Children's Asthma and Allergic Diseases and Their Home Environment-"Children-Health-Homes" Phase I Study

Background-During the last 30-50 years, the prevalence of children's asthma and allergy has been increasing dramatically worldwide. Indoor environment, especially in homes, is suspected to play an important role in this increase. A global network study on "asthma and the home environment" started in Sweden, followed by Bulgaria, Singapore, Taiwan, Denmark, USA, South Korea and China. Aim-To picture a global map on the prevalence of asthma and allergy in children as well as on characteristics of homes and indoor environmental exposures; to identify general and specific risk and protective factors for asthma and allergy among children. Methods-The "Children-Health-Homes" global study consist of two phases. In phase I, information on children´s health and their home environment is collected in a baseline questionnaire survey. In phase II, a case-control study is conducted including measurements of indoor environmental parameters as well as medical examinations. This paper includes phase I data. Results-In Phase I more than 100,000 children up to 8 years old participated with response rates from 35% to 79% in eight countries. The prevalence rate of doctor diagnosed asthma varied from 4.4% (Bulgaria) to 15.6% (USA), hay fever from 2.0% (Denmark) to 27.2% (USA), Current rhinitis from 10.2% (Denmark) to 50.9% (USA). The rate of PVC flooring ranged from 0.9% (Denmark) to 57% (South Korea). Air conditioning units were installed in 46% Singaporean families and in 81% in USA, while natural and micahnical ventilation system were reported by 84% Swedish families. The rate of visible mold on indoor surfaces ranged from 1.5% (Sweden) to 22% (South Korea). The rate of breast feeding less than 3 months ranged from 15% (Sweden) to 65% (USA). Conclusions-These results suggest substantial worldwide variations in the prevalence of asthma and allergy, home environment and life style. These differences may offer important clues to environmental influences on allergy.

Abstract Number	**O-3-17-02**
Presenter	Robin Whyatt*, Rachel Miller, Andrew Rundle, Matthew Perzanowski, Antonia M. Calafat, Allan C. Just, Kathleen Donohue, Lori Hoepner, Frederica Perera
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cohort study

Interactions between prenatal and early-life exposures to butylbenzyl phthalate and bisphenol -A on risk of asthma and other respiratory symptoms

Background: Our research has shown significant associations between exposures to prenatal butylbenzyl phthalate (BBzP) and postnatal bisphenol A (BPA) and childhood asthma and other respiratory problems. Here we evaluate whether these endocrine disruptors interact to increase the risk of asthma, wheeze and urgent care visits. Methods: We measured monobenzyl phthalate (MBzP, metabolite of BBzP) in maternal prenatal spot urine and BPA in child spot urine at ages 3, 5 and/or 7 years among N=308 inner-city mother-child pairs in New York City. History of wheeze and urgent care visits was gathered by repeat questionnaire between child ages 5-11 years. Current asthma was diagnosed by a physician using standardized criteria. Children with no history of wheeze or other asthma-related symptoms were considered non-asthmatic. Mean of ages 3-7 BPA concentrations were calculated for each child. Models controlled for specific gravity and potential confounders. Results: Among children with postnatal BPA concentrations above but not below the median, maternal prenatal logeMBzP was associated with asthma and reported wheeze ($p<0.05$). Similarly, among women with prenatal MBzP above but not below the median, child postnatal logeBPA was associated with asthma and wheeze ($p<0.05$). Comparing subjects with prenatal MBzP and postnatal BPA above to those with one or both below the median, the relative risk was 1.73 (95% CI 1.24, 2.41) for current asthma, 1.92 (95% CI 1.17, 3.21) for early onset persistent wheeze, and 1.73 (95% CI 1.29, 2.48) for urgent care visits. The interactions between MBzP and BPA were significant for asthma ($p=0.03$) and any report of wheeze between ages 5-11 years ($p=0.045$). Conclusion: Results suggest a significant interaction between prenatal MBzP and postnatal BPA on child asthma and wheeze, and the possibility of a 'two-hit model' where higher BBzP exposure during pregnancy may render the child more susceptible to the effects of BPA exposure in early childhood.

Abstract Number	**O-3-17-03**
Presenter	Huan Shu*, Bo A.G. Jönsson, Malin Larsson, Eewa Nånberg, Carl-Gustaf Bornehag
Exposure	household air pollution
Health domains	allergies
Type of research	cohort study

PVC-flooring at home and development of asthma among young children in Sweden, a 10-year follow-up

Background The incidence of asthma and allergy has increased throughout the developed world over the past decades. During the same period of time the use of industrial chemicals such as phthalates, which are commonly used as plasticizers in polyvinylchloride (PVC) flooring material, has increased. There is a growing body of literature showing an association between phthalates and allergic symptoms in children but most of the epidemiological studies are of a cross-sectional design. Aims To investigate if PVC-flooring in the home of children in the age of 1-5 years is associated with the development of asthma in a 10-year follow-up investigation (n=6173). Methods DBH study commenced in the year 2000 in Värmland, Sweden with a baseline questionnaire to the parents of 14,077 children in the age of 1-5 years. Ten years after the baseline, follow-up questionnaire was sent out to all children from the baseline (n=15,043) and 7,806 responded (54%). Frequency calculation and logistic regression analysis were applied to questionnaire results, which were adjusted for age, sex, smoking in the family, single parenthood, and multi-family housing Results The main findings of this analysis were a statistically significant association between the existence of PVC flooring in parents' bedroom in child's early life and doctor diagnosed asthma during the following 10 years. In contrast, an association was not as strong for children's bedroom PVC flooring and asthma. Conclusions We have earlier showed that PVC-flooring indoor is one source for phthalate exposure (BBzP) in indoor dust and we have shown that PVC flooring material is related to uptake of phthalates (BBzP) in infants and we have reported that the concentration of phthalates in indoor dust (BBzP) are associated with allergic symptoms in children. The current results further point to a possible relationship between PVC in early life environment and development of asthma in children.

Abstract Number	**O-3-17-04**
Presenter	Nicholas Osborne*, Chris Thornton, Richard Sharpe
Exposure	household air pollution
Health domains	allergies
Type of research	cross-sectional study

Damp, fungi and risk of atopic disease in Cornwall, UK

Background Atopic disease is highly prevalent in the UK and asthma effects 10% of the population and costs the National Health Service £1 billion per year. Asthma is complex disease with both genetic and environmental aetiologies and exposure to fungi has been implicated in increased risk of both development and exacerbation of these diseases. Aims Examine the relationship between fungi and asthma prevalence and to examine increased risk of disease on the exposure to particular genera and species of fungi. Methods Sampling occurred in a population of community housing in Cornwall UK during 2012-3. Participants were recruited through contact with the local community housing authority. Participants were asked questions about health and behaviours and presence of fungi by questionnaire to gather data on exposure and outcomes. Sampling of fungi occurred in a selection of homes and culturable fungi identified to species level by sequencing of the ITS1-5.8S-ITS2 rRNA-encoding regions of isolates. Results Data from the pilot study revealed that residence in an apartment reduced the risk of indoor fungi (OR 0.24 95% CI 0.07-0.77). Risk factors that increased the risk of the presence of fungi included detached/semi-detached housing (crude OR 4.54 95% CI 1.44-14.27), pre-1960's construction (crude OR 3.21 95% CI 1.18-8.71), pet ownership (crude OR 7.29 95% 2.45-21.62) and building occupancy >3 people (crude OR 4.35 95% CI 1.39-13.61). No associations were found with carpeting, ventilation or heating, drying clothes indoors and energy efficiency. ITS sequencing identified a variety of different fungi species found in the domiciles. Conclusions Built environment and behaviours of residents influences both the extent of indoor fungi growth, and species diversity.

Abstract Number	**O-3-17-05**
Presenter	Meryl Colton*, Kanistha Chatterjee, Patrick Ryan, Yang Qiu, Tiina Reponen, Gary Adamkiewicz
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Indoor Air Quality and The Fractional Concentration of Exhaled Nitric Oxide in Asthmatic Children

Background: The fractional concentration of exhaled nitric oxide (FENO) is a non-invasive measure of poor asthma control. The indoor environment presents a complex array of pollutant exposures, which must be characterized to isolate the effects of a single pollutant on asthma morbidity. Aims:To quantify the effects of indoor PM2.5 and formaldehyde (FA) on FENO after controlling for the effects of pollutants emitted from similar sources (second hand smoke [SHS] and outdoor PM2.5). Methods:We measured indoor PM2.5 and FA over a five-day sampling period in the homes of 95 asthmatic children in the Green Housing Study. In multivariate regression models, we controlled for exposure to SHS and outdoor PM2.5 using urinary cotinine concentrations and outdoor PM2.5 measurements from central site monitors. Results:In preliminary bivariate analysis, neither indoor PM2.5 nor FA was associated with FENO. In multivariable analysis, controlling for SHS increased the effect estimate of PM2.5, and this association was statistically significant in a model which also controlled for outdoor PM2.5 and restricted to children not on corticosteroids (0.99% change in FENO per µg/m3 increase of PM2.5 [95% CI: 0.09, 1.91]). For FA, adjusting for outdoor PM2.5 resulted in an effect estimate that was marginally significant (1.04% change in FENO per µg/m3 increase of FA [95% CI: -0.13, 2.23]), but adjusting for SHS had no effect. Conclusions:The observed association between individual indoor pollutant exposures and FENO may be confounded by co-exposure to SHS or outdoor pollutants. This analysis found that the association between indoor PM2.5 and FENO was negatively confounded by SHS, a source of indoor PM2.5. Adjusting for SHS did not modify associations with FA, suggesting that SHS is not a major FA source in our study homes. These relationships help reveal important indoor air pollution sources. Significant effects from PM2.5 were only seen in children not on inhaled corticosteroid therapy, revealing the complex interplay between asthma triggers and treatment.

Abstract Number	**O-3-17-06**
Presenter	Yinping Zhang, Baizhan Li, Chen Huang, Xu Yang, Hua Qian, Qihong Deng, Zhuohui Zhao, Angui Li, Jianing Zhao, Yuexia Sun, Jan Sundell*
Exposure	household air pollution
Health domains	allergies
Type of research	cross-sectional study

A 10 city cross-sectional questionnaire survey in China: A preliminary understanding of the riddles behind the rapid increased prevalence of children's asthma

Background-In the past two decades, China is experiencing the most rapid and dramatic changes in indoor environment exposure. Coincidently, the prevalence rate of asthma among children increased by 10%. Aims-To understand associations between the home environment in China and asthma and allergy among Chinese children. Methods-China, Children, Homes, Health (CCHH), Phase I study, is a cross-sectional questionnaire survey including 48219 children aged 1-8 years old in 10 major cities (Beijing, Changsha, Chongqing, Harbin, Nanjing, Shanghai, Taiyuan, Urumqi, Wuhan, Xi'an) of China during 2010-2011. The questionnaire used included the core questions in the International Study of Asthma and Allergies in Childhood (ISAAC) and validated questions regarding housing, life habits and outdoor environment, which has been adapted to Chinese customs and building characteristics, from the questions used in Sweden, Denmark, Bulgaria, USA, Taiwan, Singapore, and South Korea. Results-The average prevalence of asthma across China was 6.8% (range 1.7%-9.8%), hay fever 8.6% (2.2%-11.6%), current wheeze 19.2% (13.9%-23.7%), current rhinitis 41.3% (24.0%-45.5%), current eczema 12.1% (4.8%-15.8%). Rates of visible mold on indoor surfaces ranged from 4% (Xi'an; Beijing) to 12% (Harbin), condensation on windowpane in winter from 14.3% (Chongqing) to 32.2% (Nanjing), moldy odor from 0.4% (Nanjing) to 1.9% (Harbin). On average, 59% of families had environmental tobacco smoke exposure. The asthma prevalence was positively associated with the economic status indexed by Gross Domestic Production per capita of a city, but not with ambient air pollution. Conclusions- The data and information collected in this study will be helpful in finding the associations between children's health and indoor environment exposures.

Abstract Number	**O-3-18-01**
Presenter	Zev Ross*, Kazuhiko Ito, Sarah Johnson, Michelle Yee, Grant Pezeshki, Jane Clougherty, David Savitz, Thomas Matte
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	exposure modeling

Spatial and temporal interpolation of air pollutants in New York City: exposure assignment for use in a birth outcomes study

Background: Many studies of air pollution and birth outcomes are limited by spatially sparse monitoring to assess the importance of within-city exposure gradients. Aims: To develop spatio-temporal models of fine particles (PM2.5) and nitrogen dioxide (NO2) and characterize exposures during pregnancy in New York City. Methods: Data on emissions sources were used in a regression model to predict PM2.5 and NO2 concentrations collected at 150 locations in Year 1 of the NYC Community Air Survey (NYCCAS). Two-week average exposures were estimated by temporally adjusting city-wide pollutant time-series' derived from regulatory monitors. This method was validated by comparing model-based estimates to two-week measured concentrations during Year 2 of NYCCAS. The models were used to assign exposures to PM2.5 and NO2 for each trimester and the entire gestation period for 274,996 births 2008-2010 at maternal addresses and for 300m and 800m buffers around the maternal address. We then characterized the spatial/temporal variation in estimated exposures. Results: The models yielded good fits (R2=0.79 for PM2.5 and 0.80 for NO2) and predictions of Year 2 measurements (R2=0.84 for both pollutants). Estimated trimester-specific exposures showed a greater proportion of temporal-to-spatial variation for PM2.5 than for NO2. Due to the bi-annual cycle in PM2.5, exposure estimates for adjacent trimesters were less correlated than the correlation between the 1st and 3rd trimesters. For NO2, the annual cycle produced the opposite pattern. Estimated exposures were not highly sensitive to spatial buffer size. Conclusions: Spatio-temporal models using data from a dense network of monitors temporally adjusted by a city-wide time series accurately predicts pollutant concentrations. The extent of the temporal vs. spatial contribution to the overall exposure variation and correlations across trimesters varied by averaging time windows and should be considered in birth outcomes studies.

Abstract Number	**O-3-18-02**
Presenter	Ming-Yi Tsai*, Regina E. Ducret-Stich, Josef Cyrys, Marloes Eeftens, Kees de Hoogh, Kees Meliefste, Mark J Nieuwenhuijsen, Harish C. Phuleria, Martina S. Ragettli, Meng Wang, Gerard Hoek
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Spatial and temporal distribution of PM elemental composition in 20 European areas

Background: Particulate matter (PM) composition is of increasing importance for public health. This is the first European dataset of PM trace elements from harmonized sampling and centralized analysis. Aim: To characterize the spatiotemporal distributions of 26 elements within and between areas across Europe. Methods: Within the framework of ESCAPE (European study of cohorts for air pollution effects), 20 areas were monitored. In each area, an additional 20 sites were chosen to characterize within area spatial variability. PM2.5 & PM10 teflon filters were analyzed by x-ray fluorescence with about 25 elements well detected. Results: Year-round PM2.5 elemental mass gradually increased from north to south with highs in industrial areas. In contrast, coarse PM (PMc, PM10-PM2.5) elemental mass showed a more uniform level across northern/central Europe before a jump in the south. S (primarily as sulfate) is almost entirely in the PM2.5 fraction, while crustal elements (Sr, Ca, Ti, Si, Mg, Fe, Al) are mainly in the coarse fraction. Seasonal analysis comparing within-area median concentrations showed that a minority of elements have similar (R2>0.75) seasonal spatial distributions across Europe (27% for PM2.5, 38% for PMc). Most areas showed wintertime increases of K (PM2.5) from wood burning and Na & Cl (PMc) from road de-icing. Some had increases of Mg & As-maybe coal use. Within areas, many traffic related elements (eg Cu, Fe) had elevated concentrations at street sites compared to urban and regional background sites. For regional pollutants, eg S, the levels were similar regardless of site type. The varying proportions of median levels of PM2.5 & PMc across Europe by element, site type, and season reveals overlapping elemental contributions from different sources. Conclusions: Spatiotemporal distributions differed for most elements and by size fraction. Factor analysis by area would give insight into possible sources and likely provide a more health relevant exposure.

Abstract Number	**O-3-18-03**
Presenter	Aya Lavi*, Elizabeth Fireman, Oded Pochter, Itzhak Omer
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Mapping Particulate Air Pollution (PM2.5) Dispersion by Biomonitoring in Tel Aviv Metropolitan Area

Background: Health effects of particulate air pollution observed in numerous studies include increased respiratory symptoms, decreased lung function and more. Most urban networks have a few monitoring sites only, the data are sparse have been shown to be poor surrogates of personal exposure. Measurement by biomonitoring allows the most health-relevant assessment of exposure, since it gives information about existence of materials, and their direct influence. Induced sputum (IS) has a clinical meaningful through the image of mediators cells of the airway can be mapped. Research interests: (1) Mapping particulate air pollution dispersion by particle size distribution in IS micro and nanometer range in Tel-Aviv metropolitan area, compare to the environmental mapping. (2) To correlate between environmental conditions and biological parameters. (3) Determine the range of representation environmental monitors by biomonitoring means. Methods: Study group Adults >18 years old that were referred to the Pulmonary Lab for respiratory symptoms evaluation in 2007, 2009. Pulmonary function tests (PFT) were done by conventional methods. Particle Size Distribution Analysis of IS particulate matter was done by DAPI 2000 Analyzer (Donner Tech, Israel) maps of air pollution were created by Geographic Information System. Results:(1) Mapping air pollution map based on IS's results enable to map a wide area with higher resolution (2) Relations between high percent of small particles in IS found in patients with abnormal lungs functions that live in front apartment. (3) There is no correlation between environmental stations' data and biological parameters. Conclusion: (1) Accumulation of small particles in respiratory influence lung's healthcondition. (2) The biological monitoring allows a higher resolution on the environmental conditions, but bigger population is necessary (3) Integration both types environmental and biological data should determine the public health policy.

Abstract Number	**O-3-18-04**
Presenter	Elena Proietti*, Edgar Delgado-Eckert, Georgette Stern, Danielle Vienneau, Ming-Yi Tsai, Philipp Latzin, Urs Frey, Martin Röösli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A hybrid model using temporal and spatial regression to estimate air pollution exposure during pregnancy

BACKGROUND AND AIM Many epidemiological studies require the assessment of the participants' individual air pollution exposure during periods of weeks or months (e.g. during pregnancy). Widely used land use regression models have a good spatial resolution, but do not adapt to fine time variability. We aimed to develop a model suitable to assess individual NO2 exposure with a monthly time resolution in an urban environment. METHODS Putative models were trained with 4'350 NO2 monthly passive sampling measurements from 45 sites within the city of Bern, collected between 1997-2009. We considered predictors concerning traffic, roads, land use, demographics, meteorological data, and NO2 levels from a dispersion model and from fixed monitoring sites. We performed general additive models using selections of non-colinear predictors and testing for non linear relationships and time-space interactions. We finally tested the models with an internal subsample and an external validation dataset of 57 additional independent NO2 measurements. RESULTS The best prediction model for the city of Bern included NO2 measurements from a countryside fixed air quality monitoring station, yearly average NO2 estimated from a dispersion model, length of major roads and population density within 100m, traffic load within 50m, distance to the nearest major road, industrial land use within 1000m, temperature and boundary layer height. We found significant interactions between temperature and population density and between wind speed and distance to a major road. The model reached an R2 of 0.5 in the training dataset and an R2 of 0.73 in the external independent validation dataset. CONLUSION We developed a model able to predict NO2 exposure in an urban environment with monthly time resolution. The external independent dataset prevented us from overfitting the model, making it potentially more suitable for predictions in a different area or time period.

Abstract Number	**O-3-18-05**
Presenter	Roby Greenwald*, Priya Kewada, Fuyuen Yip, Jeremy Sarnat
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

A method to identify and characterize short-lived air pollution events from time-series analysis of continuously-measured parameters

Background: The concentration of air pollutants on roadways can change quickly in response to traffic conditions, meteorology, or the presence of high-emitting vehicles. These changes are not apparent when performing integrated pollutant measurements. Previous investigation has found that the maximum concentrations of several pollutants are stronger predictors of observed health outcomes than integrated concentrations, and it is biologically-plausible that health effects may be driven by short-lived exposure events. Aims: Continuous measurements of in-cabin pollutants from the Atlanta Commuters Exposure (ACE) study were analyzed to determine the frequency and magnitude of concentration events. Methods: An algorithm was developed to examine the time-series for each continuously-measured pollutant, including fine particulate matter (PM2.5), particle number concentration (PNC), black carbon (BC) and particle-bound PAHs. If pollutant levels exceeded a threshold value defined as the mean plus one standard deviation (SD) for the entire study and the pollutant concentration increased with a slope exceeding a one SD increase in one minute, an event was triggered. The event was terminated when the concentration reached a local minimum or fell below the threshold value. Results: PM2.5 levels were relatively smooth with fewer than one event per two-hour commute. All other pollutants averaged 4-5 events per commute. PNC events frequently occurred at different times than BC and PAH events. The fraction of commute exposure that occurred during an event was double the fraction of time that was during an event. In many cases, the source(s) of an event could be determined from study data. Conclusions: On-roadway exposure to particulate pollutants disproportionately occurs during discrete events. Although each event lasts only a few minutes, and the cumulative time spent in an event is 20% of on-roadway time, the event exposure approaches 50% of the total and is closely associated with observed health outcomes.

Abstract Number	**O-3-18-06**
Presenter	Xuefei Hu*, Lance Waller, Alexei Lyapustin, Yang Liu*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A Time Series Analysis of PM2.5 Concentrations in the Southeastern U.S. Using MAIAC AOD in a Two-stage Spatial Statistical Model

Background. Long term PM2.5 exposure has been associated with various health outcomes. However, ground monitoring networks leave large rural and suburban areas uncovered even in developed countries.In recent years, satellite-retrieved aerosol optical depth (AOD) has been used for PM2.5 concentration estimation due to its large spatial coverage. A limitation of the current AOD products is their coarse spatial resolution (10 – 20 km).Aims. We examined the PM2.5 predicting power of a new AOD product with 1 km spatial resolution retrieved by the Multi-Angle Implementation of Atmospheric Correction (MAIAC) algorithm. Methods. We developed a two stage spatial model with MAIAC AOD, meteorological and land use variables as covariates. The first stage linear mixed effects model accounts for the day-to-day variability of the PM2.5-AOD relationship, and the second stage geographically weighted regression model reduces the spatially varying residuals from the first stage. A 10-year model simulation was performed in the southeastern U.S. centered at the Atlanta Metro area. Results. Annual model R2 ranged from 0.52 to 0.83, and annual mean prediction error ranged from 1.97 to 2.58 µg/m3. Model performance is significantly better than a similar model developed without MAIAC AOD. Our time series analysis results showed that PM2.5 concentration level in the study area was in a general declining trend from 2001 to 2010 with the exception of 2005, which could be attributed to higher sulfate concentrations related to increased power production during the warm season.Conclusions. MAIAC AOD is a strong predictor of ground level PM2.5 when used together with effect modifiers such as temperature and wind speed. The prediction error of our MAIAC AOD model at 1 km resolution is comparable with that of a similar MODIS AOD model at 10 km resolution.

Abstract Number	**O-3-21-01**
Presenter	Anna Schembari*, Mark J Nieuwenhuijsen, Joaquin Salvador, Audrey de Nazelle, Marta Cirach, Payam Dadvand, Rob Beelen, Gerard Hoek, Bert Brunekreef, Xavier Basagaña, Martine Vrijheid
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Traffic-Related Air Pollution and Risk of Congenital Anomalies in Barcelona.

Background:A recent meta-analysis suggested some evidence for an effect of ambient air pollutants on risk of certain congenital heart defects, but few studies relied on refined spatial exposure models to investigate the effects of traffic-related air pollutants. Aims: To evaluate the excess risk of congenital anomalies associated to traffic-related air pollution exposure, estimated by temporal adjusted land-use regression models in Barcelona. Method: Cases with congenital anomalies and control births were selected from the population-based Barcelona congenital anomaly register (1994-2006). Temporally adjusted land use regression models from the ESCAPE project for NOx, NO2, PM10,PMcoarse, PM2.5 and PM2.5 absorbance, were applied to residential addresses at birth to estimate spatial and spatio-temporal exposures during week 3 to 8 of pregnancy. Associations between exposure estimates and 18 congenital anomaly groups were analyzed using logistic regression models. Results: The study included 2247 non-chromosomal cases and 2991 controls. Spatial and spatio-temporal models showed increased risks for coarctation of the aorta and NO2 (adj. ORspatio-temporal for an inter-quartile range increase in the exposure = 1.15; 95%CI 1.01-1.31), for digestive system defects and NO2 (adj. ORspatio-temporal = 1.11; 95%CI 1.00-1.23), and for abdominal wall defects and PMcoarse (adj. ORspatio-temporal = 1.93; 95%CI 1.37-2.73). Other statistically significant OR below and above one were found in the spatial model only or in the spatio-temporal model only, but not in both. Conclusions: Our results are reassuring overall as they do not indicate an association between traffic-related air pollution and most groups of congenital anomalies. The association observed between NO2 and coarctation of the aorta is consistent with the previous meta-analysis. Findings for digestive system anomalies and of abdominal wall defects are novel and call for confirmation.

Abstract Number	**O-3-21-02**
Presenter	Natalya Bilenko*, Bert Brunekreef, Rob Beelen, Marloes Eeftens, Gerard Koppelman, Marieke Oldenwening, Henriette A. Smit, Elise van Kempen, Lenie van Rossem, Alet H. Wijga, Ulrike Gehring
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Traffic-related air pollution and noise and blood pressure of children: Results from the PIAMA birth cohort study

Background. Elevations of children's blood pressure may cause possible health risks in later life. There is evidence for adverse effects of exposure to air pollution and noise on blood pressure in adults. Little is known about these associations in children. Aims. We investigated the associations of air pollution and noise exposure with blood pressure in 12-year-olds. Methods. Blood pressure was measured at age 12 years in 1432 participants of the PIAMA birth cohort study. Annual average exposure to traffic-related air pollution [nitrogen dioxide (NO2), mass concentrations of particulate matter with diameters of less than 2.5 µm (PM2.5) and less than 10 µm (PM10), and PM2.5 absorbance] at the participants' addresses at the time of blood pressure measurements was estimated by land-use regression models. Air pollution exposure on the days preceding blood pressure measurements was estimated from routine air monitoring data. Long-term noise exposure was assessed by linking home addresses to modelled equivalent road traffic noise levels. Associations of exposures with blood pressure were analysed by linear regression. Effects are presented for an interquartile range increase in exposure. Results. Long-term exposure to NO2 and PM2.5 absorbance were associated with increased diastolic blood pressure, in children who lived at the same address since birth [adjusted mean difference (95% confidence interval) 0.82 (0.10;1.54), and 0.79 (0.01;1.56), respectively], but not with systolic blood pressure. We found no association of blood pressure with short-term air pollution and noise exposure. Conclusion. Long-term exposure to traffic-related air pollution may increase diastolic blood pressure in children.

Abstract Number	**O-3-21-03**
Presenter	Ulrike Gehring*, Erica S. Schultz, Raymond Agius, Elaine Fuertes, Joachim Heinrich, Claudia Klümper, Anna Mölter, Andrea von Berg, Göran Pershagen, Bert Brunekreef
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Traffic-related air pollution and lung function in children – the ESCAPE project

Rationale: There is evidence for adverse effects of outdoor air pollution on lung function of children. Quantitative summaries of the effects of air pollution on lung function, however, are lacking due to large differences between studies. Objectives: To study the association between residential exposure to traffic-related air pollution and lung function in five European birth cohorts with a standardized exposure assessment following a common protocol. Methods: As part of the European Study of Cohorts for Air Pollution Effects (ESCAPE) we analyzed data from birth cohort studies situated in Germany, Sweden, The Netherlands and the United Kingdom with measured lung function at ages 6-8 years. Annual average exposure to traffic-related air pollution [nitrogen oxides (NO2, NOx), mass concentrations of particulate matter with diameters of less than 2.5, less than 10, and 2.5-10 µm (PM2.5, PM10, and PMcoarse), and PM2.5 absorbance], at birth and current addresses was estimated by land-use regression models. Associations of lung function with exposure to air pollution and traffic indicators were first explored by cohort using linear regression analysis. Then, cohort-specific effect estimates were combined by meta-analysis. Results: Estimated levels of NO2, NOx, PM2.5 absorbance and PM2.5 at the current address were associated with small decreases in lung function ranging from 0.86% (95% confidence interval 0.24; 1.48) per 20 µg/m3 NOx to 1.77% (0.18; 3.34) per 5 µg/m3 PM2.5 for forced expiratory volume in 1 second. Conclusions: Exposure to traffic-related air pollution may result in reductions in lung function in school children.

Abstract Number	**O-3-21-04**
Presenter	Doug Brugge*, Kevin Lane, Allison P Patton, Christina Fuller, Mei Chung, Deena Wang, Tina Wang, Wig Zamore, Mkaya Mwamburi, John L Durant
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

The Community Assessment of Freeway Exposure and Health (CAFEH) study: Overview and progress to date

Background Previous research shows excess risk of cardiovascular disease for people living close to highways or major roadways. The causes are not well established. Aims To summarize and integrate findings from the Community Assessment of Freeway Exposure and Health study (CAFEH). Methods We recruited 704 residents from neighborhoods next to major highways (<450 m from highway) and in urban background areas (>1 km from highways) in the Boston, MA area. 454 attended study clinics where blood pressure, ankle brachial index and CRP, IL-6, TNFalpha-RII, and fibrinogen in blood were measured. We used a mobile laboratory, stationary ambient sites and indoor/outdoor monitoring at 18 homes to measure particle number concentration (PNC; an estimate of UFP). Results We tested association of blood markers with stationary site PNC for acute time periods and found associations for IL-6 and TNF-RII, and trends of greater effect estimates of IL-6 and CRP for longer times. We found that same day PNC was positively associated with systolic blood pressure and pulse pressure. We found that CRP and IL-6 were higher for residents living close to the highway compared to urban background considering the influence of many potential confounders. We explored PNC levels descriptively and built regression models that predict hourly PNC for participants for a year. PNC levels were significantly affected by wind speed and direction, temperature, traffic volume, and distance from highways or major roads. We assigned exposure to ambient PNC levels at residences both with and without consideration of time-activity patterns, with evidence of differential exposure misclassification for proximity. Assigned exposures are tested for associations with health measures through regression and structural equation modeling with evidence that individualized exposures increase effect estimates. Conclusions Evidence from CAFEH is broadly consistent with UFP being associated with markers of cardiovascular risk.

Abstract Number	**O-3-21-05**
Presenter	Jeremy Sarnat*, Roby Greenwald, Priya Kewada, W. Dana Flander, Stefanie Sarnat, Fuyuen Yip, Tegan Boehmer, Amit Raysoni, Mike Bergin
Exposure	organic compounds
Health domains	respiratory disease
Type of research	others

Exposure to Traffic Pollution, Acute Inflammation and Autonomic Response in the Atlanta Commuters Exposure (ACE) Study

Background: Exposure to traffic pollution has been linked to numerous adverse health endpoints. Despite this, limited data exist which examine traffic exposures during realistic commutes and acute response. We conducted the Atlanta Commuters Exposures (ACE) Study, an extensive panel-based exposure and health study, to measure chemically-resolved in-vehicle exposures and corresponding changes in acute oxidative stress, lipid peroxidation, pulmonary and systemic inflammation and autonomic response. Methods: Twenty-one healthy and 21 asthmatic subjects participated in two, 2h scripted car commutes. We measured a range of biomarkers immediately pre- and post-commute and for 3h, each hour, post-commute. We sampled in-vehicle concentrations of size-resolved particulate matter mass and number, and organic and elemental species. Mixed effect regression models were used to examine differences between pre- and post-commute biomarker levels. Results: We observed significant ($p < 0.0001$) increases in post-commute exhaled nitric oxide (eNO) and malondialdehyde (MDA) in exhaled breath, indicative of pulmonary inflammation and lipid peroxidation, respectively. Effect modification of the eNO effect existed by disease status, with asthmatics exhibiting more pronounced inflammation than healthy subjects. Among asthmatics, we observed further modification by control status, with significantly ($p < 0.05$) higher eNO response measured in poorly- as compared to well-controlled asthmatics. Water soluble organic carbon was most strongly and significantly associated with elevated eNO; with particle-bound polycyclic aromatic hydrocarbons most predictive of MDA. There were significant decrements in heart rate variability (SDNN, rMSSD, ASDNN) in the periods following the commutes, most pronounced among the asthmatic subjects. Conclusions:In the ACE Study subjects, commuting for 2h was associated with increased pulmonary inflammation, lipid peroxidation and reduced heart rate variability in both healthy and asthmatic adults. Results for asthmatics were indicative of enhanced sensitivity.

Abstract Number	**O-3-21-06**
Presenter	Jaime E. Hart*, Stephanie Chiuve, Francine Laden, Christine Albert
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Roadway proximity and the risk of nonfatal myocardial infarction, nonsudden fatal coronary heart disease, and sudden cardiac death

Background: Exposures to traffic have been associated with increased cardiovascular (CVD) morbidity and mortality; however, the mechanisms have not been fully elucidated. Since driving and air pollution exposures have been associated with ventricular arrhythmias in patients with cardioverter defibrillators, we hypothesized that exposure to traffic might more broadly elevate sudden cardiac death (SCD) risk than other CVD outcomes. Aims: We aimed to determine the association of roadway proximity with nonfatal myocardial infarction (MI), nonsudden fatal coronary heart disease (CHD), and SCD. Methods: As a proxy for traffic exposures, we calculated distance to the nearest of several different US Census Feature Class road segments (in meters) for all residential addresses among 106,890 women from the Nurses' Health Study, a prospective cohort study of women aged 30-55 at study inception in 1976. All outcomes were confirmed through autopsy/medical record review. Information on risk factors for the outcomes of interest was available from biennial questionnaires. Time-varying multivariable Cox proportional hazards models were used to estimate hazard ratios (HR) and 95% confidence intervals (95%CI) of the effect of distance to road on disease risk. Results: There were a total of 2,676 nonfatal MIs, 1,228 nonsudden fatal CHDs, and 290 SCDs over the 24 years of follow-up (1986-2010). In adjusted models, women living closer (0-50m or 51-100m compared to 200m+) to roadways had an more elevated risk of nonsudden fatal CHD (0-50: HR: 1.24 95%CI: 1.06-1.44; 51-100: HR:1.08 95%CI: 0.95-1.24) and SCD (0-50: HR: 1.38 95%CI: 1.01-1.87; 51-100: HR:1.14 95%CI: 0.87-1.49), than nonfatal MI (0-50: HR: 1.11 95%CI: 0.99-1.23; 51-100: HR:1.07 95%CI: 0.98-1.17). Conclusions: These prospective data suggest that exposure to traffic (as measured by distance to road) is associated with a larger increased risk of SCD and nonsudden fatal CHD than nonfatal MI in this group of middle-aged and elderly women.

Abstract Number	**O-3-22-01**
Presenter	Sheela Sathyanarayana*, Emily Barrett, Christina Wang, Shanna Swan
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	cross-sectional study

Phthalate and Bisphenol A Exposure and Maternal Hormone Concentrations During Pregnancy

Background: Di(2)ethyl hexyl phthalate (DEHP) and bisphenol A (BPA) are endocrine disrupting chemicals that affect hormone physiology which leads to adverse reproductive and endocrine health outcomes in animal models. In humans, it is unknown whether DEHP and BPA exposure impacts circulating maternal hormone concentrations during pregnancy, a developmentally susceptible time period. Methods: We used multivariate linear regression to estimate associations between DEHP metabolites and BPA concentrations and concurrent serum total testosterone and estradiol levels in 157 pregnant women within the Study for Future Families. Analyses were adjusted for gestational age at blood draw, urine dilution, study center, women’s age, and educational level. Because fetal hormone concentrations may influence circulating maternal hormone concentrations, associations were also examined by infant sex. Results: Testosterone concentrations ranged from 8 to 406 ng/dl, and estradiol concentrations ranged from 529 to 40,600 pg/ml. We observed lower total testosterone (-11 ng/dl, 95%CI -19.3, -2.0) in relation to the log sum DEHP metabolites. This relationship was stronger in women who gave birth to female infants (-13.3 ng/dl, 95% CI -26.1, -0.7) as compared to male infants (-9.5 ng/dl, 95% CI -21.0, 2.0). We also observed lower estradiol concentrations (-483.7 pg/ml, 95% CI -1398.5, 431.0) in relation to log BPA exposure. This relationship was stronger in women who gave birth to male infants (-1347.0 pg/ml, 95% CI -2531.8, -162.2) as compared to female infants (223.6 pg/ml, -1370.5, 1817.7). Conclusions: DEHP and BPA exposure is associated with lower testosterone and estradiol concentrations in pregnant women, respectively, in an infant sex-specific manner. Circulating maternal hormone concentrations are extremely important for both maternal and fetal health, and this finding helps elucidate the mechanisms by which phthalates and BPA can impact endocrine physiology.

Abstract Number	**O-3-22-02**
Presenter	Alfred Franzblau*, Kendra Broadwater, William Luksemburg, Martha Maier, Xiaohui Jiang, David Garabrant, Avery Demond, John D. Meeker
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Serum Concentrations of Polychlorinated Dibenzo-p-dioxins Among Users of Ball Clay

Background: Natural contamination of ball clay with polychlorinated dibenzo-p-dioxins (PCDDs) was discovered in 1997. Reported average TEQ in ball clay has ranged up to 1500 pg/g. As many as 13.4 million adults in the US may have recreational contact with ball clay. No studies have attempted to assess blood levels of PCDDs among users of ball clay. Aims: We sought to characterize serum TEQ due to PCDDs among ceramicists and to compare this with the general population. Methods: Ceramicists were recruited from two sources: long-term (>10 years) ceramicists who were members of the Michigan Ceramics Arts Association, and current employees of a local commercial ceramic company. Study participants completed a self-administered questionnaire about diet, employment, demographics and clay practices. A 40 mL blood sample was drawn from each participant and was analyzed for 7 PCDD congeners and adjusted for lipid content. Results: Among long-term ceramicists (n=13) the mean duration of clay use was 32 years; among the commercial workers (n=14) the mean duration of clay use was 6 years. Serum TEQ of study subjects was compared to the control population of the University of Michigan Dioxin Exposure Study using published regression models adjusted for age, smoking, sex, breast feeding and BMI. Using all 27 subjects, or using long-term ceramicists and commercial workers separately, the mean serum TEQ concentrations were not elevated above background levels. Conclusion: Results from a convenience sample of long-term ceramicists and commercial ceramics workers show no evidence of significant absorption of PCDDs despite long-term contact with ball clay.

Abstract Number	**O-3-22-03**
Presenter	Bo A.G. Jönsson*, Lars Rylander, Christian H. Lindh, Virissa Lenters, Anna Rignell-Hydbom, Aleksander Giwercman, Henning S Pedersen, Gunnar Toft, Jens Peter Bonde
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Higher blood serum concentrations of bisphenol A in Greenlandic Inuit compared to men from two other European populations

BACKGROUND The knowledge about the concentrations of the endocrine disruptor bisphenol A in different populations is insufficient. AIM The aim of the present study was to describe and compare blood serum concentrations in men from three different populations. METHODS Bisphenol A concentrations in serum were analyzed by liquid chromatography/tandem mass spectrometry (LC/MS/MS) in 196 Greenlandic Inuit, 190 men from Warzaw, Poland, and 203 men from Kharkiv, Ukraine. All men were partners of pregnant women and participated in the EU funded project CLEAR (Climate Change, Environmental Contaminants and Reproductive Health; http://www.inuendo.dk/clear). The limit of detection (LOD) was 0.9 ng/mL. We compared the concentrations between the three populations as well as between Inuit from different areas in Greenland. RESULTS The fractions of men with concentrations below LOD were 52% among the Greenlandic Inuit, 85% among the men from Poland and 83% among the men from Ukraine. Among those men with concentrations above the LOD the Greenlandic Inuit had significantly ($p<0.0001$) higher concentrations (median = 7.1 ng/mL) as compared to the men from Poland (median = 2.2 ng/mL) as well as the men from Ukraine (median = 2.2 ng/mL). Within the Greenlandic population, the Inuit from the South East Greenland had significantly lower concentrations (median = below LOD) as compared to the Inuits from the Mid (median = 2.0 ng/mL) as well as from the Northern (median = 4.8 ng/mL) part of Greenland. CONCLUSIONS The continuation of the project will focus on possible reasons for the higher concentrations of bisphenol A in serum observed among the Greenlandic Inuit, especially among those from the Mid and Northern part of Greenland.

Abstract Number	**O-3-22-04**
Presenter	Ana Catarina Sousa*, M. Ramiro Pastorinho, António J.A. Nogueira, Luís Taborda-Barata, Shin Takahashi, Shinsuke Tanabe
Exposure	organic compounds
Health domains	obesity
Type of research	review

Unknown levels, uncertain sources: or all we know regarding Humans and Organotin compounds

Human activities are responsible for the production and transformation of thousands of chemical compounds. These chemicals will at some point be released into the environment, being therefore potentially available to be accumulated by wildlife and humans. Organotins (OTs) are among such chemicals. With an annual production of over 60,000 tons, they comprise a vast number of compounds used with three main purposes: as biocides; as stabilizers in the plastics industry; and as catalysts for the production of polyurethane foams and silicones. The excellent biocidal properties of tributyltin (TBT) (and its effects on non-target species), are most probably the cause for OTs notoriety. This compound was extensively used in antifouling paints which lead to a global contamination of the marine environment. Due to its persistency and demonstrated deleterious effects, including, e.g., endocrine disruption, TBT was banned on a global scale in 2008. Despite the tremendous attention from the scientific community to the levels and effects of OTs in the aquatic environment the same level of effort was not undertaken regarding humans. However, the widespread industrial application grants OTs a ubiquitous presence in every aspect of human life through clothes, pillows, toys, wallpaper, plastic food containers, pipes (including drinking water mains and household piping) and medical devices. This scenario creates frequent exposure opportunities by dermal contact with consumer products or through ingestion of contaminated dust, which are cumulative with the ingestion of contaminated food (particularly seafood). Without surprise, organotins have already been detected in human samples and toxicity data reveals that they are endocrine disruptors, imunotoxicants, and carcinogens, being recently linked to obesity. In this wok a thorough review on the OTs burden in human tissues is performed. Possible exposure sources are also unraveled and risk towards humans addressed.

Abstract Number	**O-3-22-05**
Presenter	Madeleine Kangsen Scammell*, Wendy Heiger-Bernays, Michael McClean, Eric Suuberg, Leigh Friguglietti, Ali Gharehtapeh, Jennifer Ames, Rui Shen, Brittany Weldon, Kelly Pennell
Exposure	organic compounds
Health domains	other
Type of research	exposure measurement

Vapor Intrusion of VOCs and Indoor Exposure Risk: A Field Study in an Urban Neighborhood

Background: Characterizing vapor intrusion (VI) exposure risk often involves the collection of indoor air samples from affected buildings. Interpretation of field data and the assessment of health risks are widely recognized as challenging. Aims: To conduct field measurements at a well characterized site with the goal of improving VI models of transport mechanisms and risk characterization. Methods: Owners of three different properties (each with different foundation-types) were recruited to participate in our assessment in a Boston area neighborhood (USA) where VI of chlorinated solvents (VOCs) was known to be occurring and regulatory action underway. Ten (10) exterior soil gas sampling locations (nested at multiple depths) and three subslab sampling locations were installed. We conducted five quarterly sampling events. At each event, soil gas, indoor air, and groundwater samples were collected. Soil moisture content was also monitored and the soil geology was qualitatively described and evaluated. We communicated results with property owners and regulatory agencies. Results: Saturated soil zones appear to act as impervious barriers to vapor transport. Geologic features may also affect vapor transport. In several locations geologic stratigraphy correlated with soil gas concentrations. We identified the infiltration of sewer gas at one property resulting in PCE concentrations in indoor air that were nearly two-orders of magnitude higher compared to when infiltration of sewer gas was not known to be occurring. We are identifying implications of how our research can inform and improve VI characterization methods. Conclusion: Site models for VI should consider sewer lines as potential sources of volatile organic chemicals to indoor air, as well as geologic features that may restrict vapor transport. The integration of modeling results and field data, can be used to better understand site conditions and the potential for vapor intrusion exposure and health risk.

Abstract Number	**O-3-22-06**
Presenter	Jianwen She*, Dasheng Lu, Ho Sai Simon Ip
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Measurements of persistent organic pollutants (POPs) in a single drop of blood

Background: the dry blood spot (DBS) sampling technique has been extensively used not only in clinical and disease studies but also in human biomonitoring for environmental chemicals. DBS requires only a few drops of blood and the collection, shipping and storage of samples are easy. Aims: Develop a quantitative method that requires only a small volume (50 µL) of blood or a single DBS for the determination of polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs). Method: The target analytes include five dioxin-like PCBs (dl-PCBs, 77, 105, 118, 126, 169), six marker PCBs (28, 52, 101, 153, 138, 180), three other PCBs (194, 206 209), and five PBDEs (PBDE 47, 99, 100, 153, 183). Each DBS (about 50 µL blood) was cut into small pieces, added to 500 µL of a mixture of formic acid and acetone (2/3, v/v), spiked with 20 µL 13C12 labeled IS solution, and sonicated. Target analytes in both plasma sample and dried blood spot (DBS) were analyzed by a gas chromatography/high resolution mass spectrometer (GC/HRMS). Results: Measurements of standard reference materials by the developed method were in agreement with those certified values. Other analytical criteria, such as limits of detection, recoveries, precision, accuracy and linearity of the proposed method are also reported. Conclusions: A novel analytical method for PBDEs and PCBs in small volume of blood and DBS by GC/HRMS has been developed and validated. Using one spot (corresponding 50 µL sample), the LODs of PCBs ranged from 0.002 to 0.005 ng mL−1, and LODs of PBDEs ranged from 0.007 to 0.02 ng mL−1. Precision, robustness, DBS stability and accuracy were performed for method evaluation. Our study suggested that the analysis of PCBs and PBDEs can be performed in a small drop of blood and these target analytes are stable under DBS storage condition.

Abstract Number	**O-3-23-01**
Presenter	Cecilia Scarinzi*, Monica Chiusolo, Ester Rita Alessandrini, Massimo Stafoggia, Annunziata Faustini, Francesco Forastiere, Ennio Cadum, the EPIAIR Collaborative Group Gabriele Accetta, Ester Alessandrini, Lorenzo Angiuli, Anton
Exposure	ambient air pollution
Health domains	other
Type of research	meta-analysis

Short-term effects of PM2.5 and NO2 on mortality in 25 Italian cities: the EpiAir2 project

Background. Several large epidemiological studies have provided evidence of short-term adverse effects of particulate matter (PM) and gaseous pollutants on health. In Italy, an ongoing surveillance system (EpiAir) has already studied the effects on 10 cities in the 2001-2005 period. Aims. To enlarge the surveillance program on health effects of air pollution for cause-specific mortality updating it to the period 2006-2010, extending it to a larger number of cities (25) and studying for the first time in Italy the effects of PM below 2.5 µm (PM2.5) in a consistent number of cities. Methods. Following standardized protocols, we collected daily mortality data for residents aged 35+ years for all natural, cardiac, cerebrovascular and respiratory causes. PM2.5 and nitrogen dioxide (NO2) were averaged for every city from selected monitoring stations. A two steps analysis was performed: a case-crossover analysis was conducted within each city, followed by a random-effects meta-analysis. Results. During the study period, we analyzed 422,723 deaths in 25 Italian cities for the NO2–mortality analysis, and 290,144 deaths from 13 cities for PM2.5. Statistically significant effects on natural mortality were found both for PM2.5 and NO2: percent increases of risk were 0.56% (95% confidence interval [CI]: 0.17%, 0.95%, lag 0-1) and1.14% (95% CI: 0.66%, 1.63%, lag 0-5), respectively. Delayed (lag 2-5) and prolonged (lag 0-5) effects of PM2.5 on cardiovascular mortality were also detected, with excess risks of 1.20% (95% CI: 0.34%, 2.06%) and 1.23% (95% CI: 0.19%, 2.27%) respectively. Conclusions. We found a large effect of PM2.5 on natural and cardiovascular mortality in 13 Italian cities. The large and prolonged effects of NO2 previously found (10 cities, 2001-2005) were confirmed on 25 cities, 2006-2010.

Abstract Number	**O-3-23-02**
Presenter	Evangelia Samoli*, Massimo Stafoggia, Ester Rita Alessandrini, Sophia Rodopoulou, Klea Katsouyanni, Francesco Forastiere, The MED-PARTICLES Study group.
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Short-term effects of fine and coarse particles on mortality and morbidity in 4 Mediterranean countries

Background and Aims: Few studies have investigated the independent health effects of different size fractions of particulate matter (PM), in multiple locations, especially in Europe. We investigated the short-term effects of PM with aerodynamic diameter less than 10μm (PM10), less than 2.5μm (PM2.5) and between 2.5 and 10μm (PM2.5-10) on mortality and morbidity outcomesin 10 European Mediterranean areas within the MED-PARTICLES project. Methods: We analyzed data from each city using Poisson regression models, and combined city-specific estimates to obtain overall effects. We evaluated the sensitivity of our results to co-pollutant exposures, city-specific model choice and investigated effect modification by age, sex or season. We applied distributed lag and threshold models to investigate the associations' patterns. Results: A 10 μg/m3 increase, in two days' PM2.5 concentration was associated with 0.55% (95% confidence interval (95%CI): 0.27%, 0.84%) increase in all-cause mortality, while a corresponding weekly increase was associated with a 1.91% (95%CI: 0.71%, 3.12%) increase in respiratory mortality. Stronger effects were observed in cause specific mortality, in the warm season and among those > 75 years. Coarse particles displayed consistently adverse effects which were non-significant in most mortality analyses. Regarding hospitalizations increases of 10 μg/m3 in PM2.5 and 6.3 μg/m3 in PM2.5-10 were associated with increases in cardiovascular admissions of 0.51% (95% 95% CI: 0.12%, 0.90%) and 0.46% (95% CI: 0.10%, 0.82%), respectively. Higher effects on respiratory hospitalizations were estimated at lag 0-5, ranging from 1.15% for PM10 to 1.36% for PM2.5. Conclusions: We found adverse health effects of PM2.5 on mortality and morbidity outcomes in the European Mediterranean region. Coarse particles also appear to have adverse effects, mainly on hospitalisations. The effects are more prolonged for respiratory outcomes and are modified by season and age. Acknowledgements: MED-PARTICLES EU LIFE10 ENV/IT/327

Abstract Number	**O-3-23-03**
Presenter	Sanghyuk Bae*, Youn-Hee Lim, Saori Kashima, Takashi Yorifuji, Yasushi Honda, Ho Kim, Yun Chul Hong
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Threshold of association between ambient ozone concentration and non-accidental mortality in 13 Japanese and Korean cities

Background: Ambient ozone (O3) concentration has been reported to be positively associated with mortality. However, the presence of a threshold in the association has been a controversy. Aim: The aim of the present study was to examine threshold of the association between ambient O3 concentration and non-accidental mortality in 13 Japanese and Korean cities from 2000 to 2009. Methods: We selected Japanese and Korean cities which have population of over 1 million. We constructed a dataset for each city, which consists of daily mean concentration of O3, daily number of non-accidental death, and covariates measured in the study period. We constructed Poisson regression models adjusting daily mean temperature, mean atmospheric pressure, mean relative humidity, time trend, day of the week, holidays and yearly population. The association between O3 concentration and mortality was examined assuming linear, spline and linear-threshold models. The thresholds were estimated for each city, using linear-threshold models with lowest Akaike Information Criterion. Results: The linear model examining the association between daily mortality and O3 concentration on the day did not show significant association in all of the cities except Tokyo which showed a negative association. When we explored the threshold with the spline model and the linear-threshold model using 3-day moving average of O3 concentration, thresholds were shown in all of the cities. The range of city-specific thresholds was from 13 to 55 ppb. The associations above the threshold were statistically significant in Busan, Daegu, Daejon, Kitakyushu, Nagoya and Tokyo, and the excessive risk of mortality for the 1 ppb increment of O3 above the threshold were 0.12, 0.08, 2.11, 0.21, 0.20 and 0.21%, respectively. Conclusion: We have observed thresholds of the association between daily mean ambient O3 concentration and daily number of non-accidental death in Japanese and Korean cities.

Abstract Number	**O-3-23-04**
Presenter	Kan Haidong*, Xia Meng
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Size-fractionated particle number concentrations and daily mortality in a Chinese city

Background: Associations between airborne particulate matter (PM) and health outcomes have been documented worldwide; however, there is scarce evidence relating health effects to different particle sizes. Aims: To explore the association between size-fractionated particles and daily mortality in Shenyang, China. Methods: Data on cause-specific mortality, particle number concentrations (PNCs) of particle size distributions from 0.25 μm to 10 μm, and mass concentrations of PM10 (PM≤10 μm), PM2.5 (PM ≤ 2.5 μm), PM10-2.5 (2.5 μm ≤ PM ≤ 10μm), nitrogen dioxide (NO2), and sulfur dioxide (SO2) were collected from December 1, 2006 to November 30, 2008. Quasi-Poisson regression generalized additive models (GAM) were used to explore associations between PM sizes and mortality, with natural spline smoothing functions to adjust for time-varying covariates and long-term and seasonal trends. Single- and two-pollutant models and different lag structure models were also used in our analysis. Results: PM fractions with size distributions less than 0.50 μm were found to be consistently significantly associated with increased total and cardiovascular mortality, but not with respiratory mortality. The excess risk per interquartile range increase in PNC grew with decreasing particle size and was much larger on warm days than on cool days. These associations were generally stable after co-adjustment of PM mass and gaseous pollutants. Conclusions: Our analyses suggest that PM less than 0.5 μm in size is most responsible for the adverse health effects of particulate air pollution, and that adverse health effects increase with decreasing PM size. Additionally, the PM-related health effects are much severe in warm days than in cool days in the city.

Abstract Number	**O-3-23-05**
Presenter	Hanns Moshammer*, Hans-Peter Hutter, Michael Kundi
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Daily mortality and ozone – which metric?

Background: Ozone is an aggressive gas but even worse it indicates a complex air pollution mixture. This highly reactive mixture of often only short-lived chemicals might even be better indicated not by the daily average ozone concentration but by the turn-over of ozone. We hypothesized that the daily variation in ozone concentration (the difference between night time low and early afternoon high half hour mean concentration) is a better predictor of health effects than the daily mean concentration. Methods: We performed a time series analysis on daily deaths (all causes, respiratory and cardiovascular causes as well as death in elderly 65+) in Vienna for the years 1991-2009. We controlled for seasonal and long term trend, day of the week, temperature and humidity using the same basic model for all pollutant metrics. Results: We found model fit was best for same day variability of ozone concentration (calculated as the difference between daily hourly maximum and minimum) and hourly maximum. Of these the variability displayed a more linear dose-response function. Maximum 8h moving average and daily mean value performed not so well. Nitrogen dioxide (daily mean) in comparison performed better when previous day values were assessed. Same day ozone and previous day nitrogen dioxide effect estimates did not confound each other. Conclusion: Variability in daily ozone levels or peak ozone levels seem to be a better proxy of a complex reactive secondary pollutant mixture than daily average ozone levels in the Middle European setting. If this finding is confirmed this would have implications for the setting of legally binding limit values.

Abstract Number	**O-3-23-06**
Presenter	Kazuhiko Ito*, Jennifer L. Peel, Jason Sacks
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Influence of seasonal adjustment in regression models on mortality risk estimates for multiple ambient air pollutants

Background: The influence of model specification on risk estimates from time-series studies of air pollution is an important issue. Recent studies reported that ozone risk estimates are sensitive to the extent of adjustment for seasonal/temporal trends, but they have not identified the appropriate amount of adjustment. Aims: To identify the extent of temporal adjustment required to control for influenza epidemics and to characterize the sensitivity of fine particle (PM2.5) and gaseous pollutant mortality risk estimates to alternative model specifications. Methods: We characterized the effect of influenza epidemics on air pollution-mortality risk estimates for 33 U.S. cities with year-round PM2.5, ozone, nitrogen dioxide (NO2), sulfur dioxide, and carbon monoxide (CO) data for 2001-2006. Residuals from Poisson models were examined that considered 3 to 12 degrees of freedom per year (df/yr) to fit temporal trends with natural splines. Excess mortality risk was calculated for an interquartile range increase in the average of 0- and 1-day lags for all pollutants for all-year, warm (April-September) and cold (October-March) seasons by varying the extent of temporal adjustment in three models with alternative weather specifications similar to those used in previous multi-city studies. Results: Influenza peaks were not adequately fitted with small temporal adjustment, such as 3 df/yr, as reflected in residual diagnosis. The impact of the extent of temporal adjustment on estimated excess mortality risks for pollutants varied across the alternative weather models and by seasonal subsets. The risk estimates for CO and NO2 were particularly sensitive to alternative weather model specifications. Conclusions: In multi-city mortality time-series studies that include large cities where influenza peaks are prominent, small df/yr for temporal adjustment is not recommended. Therefore, sensitivity analyses should only be conducted for models that adequately control for temporal trends.

Abstract Number	**O-3-28-01**
Presenter	Tobias Schripp*, Michael Wensing, Sebastian Wientzek, Tunga Salthammer
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Emissions from Wood Burning Stoves and Ethanol Fireplaces into the Indoor Environment

Background: The use of combustion heat sources regained importance in the past years due to increasing energy costs. In contrast to enclosed wood burning stoves (WBS), the use of open ethanol-based fireplaces is a common decoration trend. However, all combustion products these devices generate are released into the indoor environment. While the outdoor emission from WBS is strictly regulated in Germany, the indoor release of combustion products is rarely considered. Methods: 8 ethanol fireplaces (3 liquid, 5 gel) were tested in a 48 m^3 emission test chamber according to the recommendations of the manufacturer and DIN 4734-1. The following parameters were monitored: Particles (5 nm – 20 µm), NOx, CO, CO2, HCHO. VOCs were measured discontinuously. 6 WBS were tested in private homes between Nov 2012 and Feb 2013. The indoor air quality was monitored before, during and after operating the WBS. In addition to the mentioned parameters PAH and PM2.5 were determined indoors and outdoors. Results: Operating the ethanol fireplaces significantly affected the indoor air quality. During the operation of some devices the German guidance values for CO2 (2000 ppm) and NO2 (350 µg/m^3) were exceeded. Few systems showed considerable release of HCHO. Ethanol fireplaces as well as WBS were significant sources for ultra-fine particles. The expected human exposure against particles was estimated on the basis of the ICRP lung deposition model and compared with outdoor air exposure. An increase of benzene and PAH in indoor air was detected during the operation of some WBS. Conclusions: The results of this orienting study illustrate that ethanol fire places and WBS are important sources for indoor air contaminants. Especially under the aspect of lowering indoor air exchange rates (energy saving) and increasing use of fuels with net zero carbon footprint this is a topic of high importance. With regards to consumer safety, future product developments should focus on indoor air quality in addition to the present fire protection requirements.

Abstract Number	**O-3-28-02**
Presenter	Benjamin Hanoune*, Marion Carteret, Corinne Schadkowski, Aurore Deconinck
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

A pilot study of indoor exposure to pollutants from kerosene space heaters

Kerosene space heaters are used in about 10% of French households. Because they are unvented devices, pollutants build up in the rooms during their use. In a recent laboratory study, we have shown that only wick type kerosene heaters significantly emit CO, specially when soot accumulates on the heater, but that with all heaters, high NO2 and CO2 concentrations are to be expected, exceeding the recommended values for indoor air. The aim of this work was to confirm that the concentrations of pollutants in households using a kerosene heater correspond to the estimates from laboratory emission factors measurements, and to evaluate the exposure of people to these emissions. This work was also intended to prepare the analytical protocols for a future full scale study investigating the link between kerosene heater use and respiratory diseases. Measurements were performed in 6 dwellings, during winter 2010-2011, using CO, CO2, T, RH real-time probes, and passive sampling techniques for NOx, VOCs, and aldehydes. The characteristics of the dwellings and the activities possibly influencing the air quality during the week-long measurements were documented with questionnaires. Average daily duration of use of the heaters ranged from 2 to over 10 hours. CO2 concentration patterns and levels are a clear tracer of kerosene heater use. Daily average CO2 concentrations, up to 1700 ppb, are proportional to the duration of use, and so are the weekly average NO2 concentrations, ranging from 30 to 580 ppb. Only in the houses with wick-type heaters were the CO concentrations non zero, with an average 1-h maximum of 12 ppm. VOCs and aldehydes concentrations were low, with formaldehyde for instance not exceeding 12 ppb (1-week average), in accordance with laboratory results. These results agree with the estimates from laboratory emission factors measurements, and confirm that the use of kerosene heaters leads to poor indoor air quality and increases the exposure to respiratory irritants.

Abstract Number	**O-3-28-03**
Presenter	Charles Rodes*, Ryan Chartier
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Assessing Strong PM Source Levels and Patterns of Exposure Using Log-Probability Analyses of Cookstove Study Data

Rodes, C.1., Chartier, R. 1 Background Chronic diseases with long latency have been shown to be associated with elevated PM exposure levels. But data are needed to evaluate how acute exposure patterns influence pneumonias. Strong intermittent sources such as solid fuel smoke from indoor cooking fires create widely varying patterns in concert with high mean levels. How should we measure and analyze these exposure data to devise the most robust exposure-response health studies? Aims Measure integrated and time series PM data and place into log-probability formats to gauge the information content. Determine the influence of co-factors on the distributional parameters including data variability (GSD's). Examine the information content gained or lost by adding personal level monitoring for the cook, to a fixed location indoor monitor. Methods Utilize the RTI MicroPEM exposure monitor in personal and indoor sampling modes to collect filters and measure real-time data in indoor air pollution (IAP) settings. Apply temporal analyses and log-probability graphing, computing and comparing GSD values for each time period, location, and scenario. Results Time series graphs were not very informative. Log-probability formatting clearly divided background and burn period exposures (distinctly different GSD's), and defined the probit level thresholds. The inflection point between the log-normal lines represented the fraction of time the stove operation influenced exposures. Burn period GSD levels were influenced by the presence of multiple stoves and the level of air exchange. Conclusions Log-normal analyses provided new insights for IAP settings and explained how the exposure variability changed between background and cookstove burn periods. Utilizing the inflection point eliminates the need for stove burn monitoring. The log-probability output provides a strong format for gauging the importance of exposure patterns along with level data across participants, stove types, and studies.

Abstract Number	**O-3-28-04**
Presenter	Kiyoung Lee*
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Accuracy of Exposure Factors of Consumer Products in Korea

Background: Exposure factors of various consumer products are needed for newly proposed chemical regulation in Korea. Korean government wants to include risk assessment for regulation of chemicals in consumer products. Since use patterns of consumer products in Korea are different, national database for exposure factors is needed. Aims: Exposure factors of some consumer products like cleaning products, infection control products and paints were determined by survey of 2,500 households. Methods: The households will be randomly selected from national population database. Field survey staff visited home and collected consumer product use information by questionnaire. Field technicians also visited 100 households twice and investigated use of all consumer products. Information from questionnaire and home visit was compared. Results: Proportion of user population were higher than 97% for toothpaste and shampoo. Median amounts of toothpaste and shampoo per use were 667 mg and 6188 mg, respectively. Conditioner, body cleanser and face cleanser were used by about 60% of population. Those consumer products were used by certain age groups and gender. Frequency of shampoo use in Korea was 0.97 per day. Dish washing cleanser was mainly used by female. People usually used dish washing cleanser twice per day and 9.3 minutes each time. Powder detergent was used by 62% and liquid detergent was used by 25%. Most household used chlorinated cleanser but use of specific purpose cleanser was less frequent. Amount of use for consumer products was comparable between questionnaire and home visit. During home visit, amount of consumer products per use was quantitatively measured. The ratios of use amount were between 0.7 and 1.4. The most consumer products had the ratio of 1.0. However, use amounts of chlorinated cleanser were overestimated by questionnaire. Conclusions: Questionnaire by home visit provided accurate exposure factor of consumer.

Abstract Number	**O-3-28-05**
Presenter	Yilin Tian*, Yan Ma, Andrea Ferro
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

A Comparison of Methods for Estimating Surface Loading and Size Distribution for Settled Dust on Floorings

Settled dust found in indoor environments may contain various toxic pollutants, posing potential health risks to the occupants through inhalation, ingestion and dermal contact. Accurate measurement of settled dust level in residents can reduce uncertainties in exposure assessment. This study presents a sampling methodology that can provide direct measurement of total surface loading and size distribution for settled dust on different type of floorings. The sampling methodology (HVS3-MOUDI) is comprised of a HVS3 vacuum (CS3,Inc.) and a six-stage cascade impactor (MOUDI™) that measures the size distribution for particles range between 0.56 µm to 10µm. The methodology was validated using deposit with known surface loading and size distribution. This study compared the sampling efficiencies of the sampling methodology and the standardized micro-vacuum sampling method (ASTM D7144) on carpets and vinyl floorings. Field samplings were conducted using the sampling methodology in 20 houses among Potsdam, NY. Preliminary results showed that carpets were associated with higher settled dust level in comparison of hard floorings.

Abstract Number	**O-3-28-06**
Presenter	Dustin Poppendieck*, Richard Corsi
Exposure	household air pollution
Health domains	other
Type of research	exposure measurement

Methamphetamine Desorption from Wallboard During Remediation Conditions

Methamphetamine is an inexpensive and highly addictive drug that has been a social scourge on the United States and other countries. Over 12 million Americans have used methamphetamine and approximately 10,000 illicit methamphetamine labs are identified in the United States each year. These labs are often found in residential buildings, which can become highly contaminated with methamphetamine. Studies to understand methamphetamine decontamination are lacking in the published literature, and guidelines for methamphetamine lab remediation are empirical, at best. The objective of this study was to determine the efficacy of two remediation techniques for homes contaminated with methamphetamine: (1) enhancing desorption by elevating temperature while ventilating the interior space, and (2) painting over affected wallboard to seal the methamphetamine in place. The removal of a methamphetamine surrogate, N-isopropylbenzylamine (NIBA), from 32 ˚C wallboard chambers at two relative humidities was studied. Chambers were spiked by continuous exposure to NIBA vapor for 14 or 16 days under static conditions. During emission testing flow rates through the 16.4 L chambers averaged 57.4 L/h resulting in an air exchange rate of 3.5/h. Air sampling was performed using an SPME fiber quantified using zero-path thermal desorption followed by GC-FID. Emission rates from wallboard after 15 days under remediation conditions ranged from 0.040-1.3 mg/h m2. Less than 25 % of the NIBA was removed from the chambers over a time period longer than used for most remediation efforts. Raising the relative humidity from 27 % to 49 % increased the emission rates by a factor of 1.4. However, even at the higher relative humidity less than 11 % of the total spiked mass was removed after three weeks of remediation conditions. Painting the chambers walls reduced emissions by less than 15 %. The results indicate elevating temperatures during remediation and painting impacted wallboard will not significantly reduce methamphetamine emissions from wallboard.

Abstract Number	**O-3-29-01**
Presenter	Mildred Maisonet*, Caroline M Taylor, Adrianne K Holmes, Michele Marcus, Jouni Jaakkola, Jean Golding
Exposure	metals
Health domains	reproductive outcomes
Type of research	cohort study

Gestational lead concentrations and timing of menarche in girls enrolled in the Avon Longitudinal Study of Parents and Children

Background. Lead is a persistent, toxic substance and its exposure has been associated with later puberty onset and maturity. Current literature on the role of lead on puberty timing of girls is limited and understanding of mechanisms unclear. Aims. To explore the association of gestational lead concentrations with timing of menarche. Methods. The study population was the Avon Longitudinal Study of Parents and Children. Repeated assessments of menarcheal status were obtained from girls from age 8 through 17. Whole blood samples were obtained in 1991-92 from mothers during the girls' gestation and lead levels measured using cell mass spectrometry. Potential confounders or effect modifiers considered include: mothers' education, age at delivery, and smoking during gestation; parity; and the girls' weight status at age 7. Classification of body mass index (BMI) into healthy or overweight/obese weight status was done using the BMI cutoffs for children developed by the International Obesity Task Force. Data analyses involved 918 enrollees of white race. Parametric survival modeling was used to estimate median ages of entry into menarche in months. Results. The median age of menarche attainment was 150 months (12.5 years). Median lead concentration was 3.4 µg/dL (interquartile range 2.7-4.3 µg/dL). Lead exposure was associated with timing of menarche in models adjusted for the mothers' age at delivery, smoking, and parity after stratification by the girls' weight status. Direction of the associations differed by weight status. On average, the estimated median age of entry into menarche per 1 µg/dL increase in lead concentrations in healthy weight girls occurred 0.7 months later (95% confidence interval [95%CI]: 0.1, 1.3) and in obese/overweight girls occurred -1.9 months earlier (95%CI: -3.6, -0.1). Conclusions. The influence of lead exposure on the timing of puberty may be mediated through alterations in growth.

Abstract Number	**O-3-29-02**
Presenter	Maria Tellez Plaza*, Wan Y. Tang, Yan Shang, Jason G. Umans, Kevin A. Francesconi, Walter Goessler, Jonathan Pollak, Eliseo Guallar, Shelley A. Cole, M. Danielle Fallin, Ana Navas-Acien
Exposure	metals
Health domains	no health domain
Type of research	others

Global DNA Methylation and Global Hydroxymethylation in a Population-based Pilot Sample from the Strong Heart Study

Background: The association between human blood DNA global methylation and global hydroxymethylation has not been evaluated in population-based studies. No studies have evaluated environmental determinants of global DNA hydroxymethylation, including exposure to metals. Aims: To evaluate the association between global DNA methylation and global DNA hydroxymethylation in a subsample of 48 Strong Heart Study participants who had selected metals measured in urine at baseline and DNA available in 1989-1991 and 1998-1999. Methods: Global 5-methylcytosine (5-mC) and 5-hydroxymethyl-cytosine (5-hmC) levels in DNA were measured by capture and detection antibodies followed by colorimetric quantification. We used linear regression models to evaluate trends and compare relative differences in methylation and hydroxymethylation levels by participant characteristics (age, sex, education, adiposity, smoking, alcohol intake, metal exposure and arsenic metabolism). Results: The Spearman's correlation coefficient for 5-mC and 5-hmC levels was 0.32 (p –value = 0.03) at visit 1 and 0.54 (p – value < 0.001) at visit 3, with consistent trends for both epigenetic markers across characteristics. The associations were significant for urine cadmium concentrations and global methylation and for arsenic metabolism and global hydroxymethylation. Conclusions: Our findings support that both epigenetic measures are related at the population level. The consistent trends in the associations between these epigenetic modifications and the characteristics evaluated suggest the need for understanding which of the two measures is a better biomarker for environmental epigenetic effects in future large-scale epidemiologic studies.

Abstract Number	**O-3-29-03**
Presenter	Jia Guang*, Shanfa Yu, Ji Zhang, Tiancheng Wang, Yang Li, Yanshuang Song
Exposure	metals
Health domains	other
Type of research	occupational study

New Evidences about Adverse Health Effects Based on Chromate Environmental and Biological Exposure Assessment in Chromate Manufacturing Workers

Background Chromium (Cr) compounds are produced and applied widely. Aims On the basis of chromate exposure assessment, Cr related trace element homeostasis, DNA damage and global DNA methylation status, renal damage need further investigation. Method We recruited more than one hundred workers from chromate producing facilities as testing subjects and matched local residents without chromium exposure history served as controls. Personal sampling of airborne Cr (A-Cr) was conducted and Cr content was quantified by Flame Atomic Absorption Spectrometry. At the end of the sampling shift, blood and urine samples were collected and element concentrations were measured by inductively coupled plasma mass spectrometry and inductively coupled plasma atomic emission spectrometry. Adverse health effects including renal impairment, DNA damage, DNA methylation, and multi-trace element homeostasis were investigated comprehensively. Results 90% of the chromate production workers were exposed to A- Cr lower than 50 mu g m(-3).Chromate caused renal impairment with more severity in the tubule than glomerular. After Cr(VI) exposure, a significant increase in blood Cr, Cd, Fe, Mg, Mo, Se and Zn concentrations was observed, as well as a significant decrease in Ca concentration. Blood Cr (B-Cr) was four times higher than that of the controls, and significantly correlated with A-Cr (r = 0.568, P<0.001). Binucleated cells with micronuclei (BNMN) frequencies were positively correlated with B-Cr and U- Cr; Ln BNMN was regressed on B-Cr, and U-Cr and A-Cr by linear models.We also found that the decreased serum folate was associated with an increased urinary 8-OhdG, DNA strand breaks and global DNA hypomethylation. Conclusions We provided some new evidences about chromate health adverse effects .Based on the above evidences and others, we therefore proposed a modified health surveillance system for chromate workers.

Abstract Number	**O-3-29-04**
Presenter	Jian Xu*, Chong-huai Yan, Jin-song Zhang, Jun Zhang, Xiao-ming Shen
Exposure	metals
Health domains	mental health
Type of research	exposure measurement

The concurrent exposure of maternal stress and selenium deficiency in Shanghai recent immigrant pregnant women

BACKGROUND: Although the risk of concurrent exposure of maternal stress and high lead or selenium deficiency during pregnancy often is assumed to be high among city immigrant women, population-based data are lacking. AIMS: We aimed to address this gap to investigate the concurrent exposure of maternal stress and high lead or low selenium in Shanghai pregnant women. METHODS: A stratified cluster sampling methodology was used to investigate 1675 pregnant women in Shanghai in 2011. Pregnant women were divided into three groups according to numbers of years of continuous stay in Shanghai (≥5years, 2~5years, and <2years). Maternal blood lead and serum selenium concentrations were tested. High lead and low selenium exposure levels were respectively defined as the upper (P75 - P100) and the lower (P0 – P25) quartiles. Maternal event stress and emotional stress were tested by self-administered questionnaires respectively using “Event Stress Scale for pregnant women” and SCL-90 Scale. RESULTS: The “<2years” group has the highest blood lead and highest event stress and emotional stress levels, while the “≥5years” group has the least levels (all p<0.05). In addition, the “<2years” group has the least serum selenium, while the “≥5years” group has the highest levels (p<0.05). After controlling maternal age, social-economic status, district and BMI, compared with the “≥5years” group, the “<2years” group had a higher risk to develop maternal low selenium and event and emotional stress, but no significant risk of maternal high blood lead (for low selenium, ORs=1.95, 95% CI: 1.22-3.11; for event stress, ORs=1.60, 95% CI: 1.02-2.55; for phobic anxiety, ORs=2.50, 95% CI: 1.39-4.50; for interpersonal sensitivity, ORs=1.75, 95% CI: 1.02-3.14). CONCLUSIONS: Recent immigrant pregnant women in Shanghai are at high risk of developing concurrent exposure of maternal stress and selenium deficiency, but not the co-exposure of maternal stress and high blood lead.

Abstract Number	**O-3-29-05**
Presenter	Susan M. Pinney*, Robert L. Herrick, Jeanette M Buckholz
Exposure	metals
Health domains	other
Type of research	health impact assessment

Uranium exposure to a community population: renal proximal tubule damage and other biomarkers of renal function

Background: We evaluated uranium exposure estimates, urine uranium and biomarkers of renal function in the Fernald Community Cohort (FCC), a volunteer population who lived within 5 miles of a uranium ore processing plant in Fernald, OH, USA during plant operation (1951-1989) and followed 1990-2008 in a medical monitoring program which included clinical laboratory measurements of biomarkers of renal function. Uranium plant workers were excluded. Materials and Methods: Releases of soluble and insoluble uranium particulates from this plant during operation from 1952-1989 were used by the US Centers for Disease Control and Prevention in developing dose estimation models, and we used this algorithm to estimate U exposure for 8770 persons in the FCC. We conducted a validation study of 189 members of the cohort, selected on exposure criteria (highest exposure scores, with and without a well or cistern as a drinking water source). Urine samples of these 189 persons, collected in the early 1990’s, were submitted to the US Armed Forces Institute of Pathology for urine U measurements. Results: Urine uranium (U) levels for most of this study sample were within the 1999-2000 NHANES normal population 95% reference interval (0.006-0.009 µg/gr Cr); 12% were above the 95th% value. Geometric mean concentrations were highest for those using a well (0.010 ug/gCr) or cistern (0.009 ug/gCr) as a drinking water source compared to those living far from the plant (0.007 ug/gCr). A strong correlation existed between urine U and urine β -2-microglobulin (β2M, a biomarker of renal proximal tubule function) in sub-groups of those with high β2M (R=0.664-Spearman), and a mild correlation among those using a well (R=0.238, Pearson) or cistern (R=0.218, Spearman) as drinking water source. Serum creatinine, blood urea nitrogen and urinary microglobulin also were associated with urine U. Conclusions: Chronic, low dose uranium exposure including soluble uranium particulates is reflected by urine U concentration and is associated with renal health effects.

Abstract Number	**O-3-29-06**
Presenter	Horacio Riojas Rodríguez*, Urinda Alamo Hernández, Fernando Díaz Barriga, Hilda Rangel, Norma Garduño Salazar, Celso Ramos, Ana Cecilia Espinosa
Exposure	metals
Health domains	other
Type of research	others

Environmental health in Alpuyeca, México. An ecosystem approach.

Background: Alpuyeca has a complex environmental health problematic showing high lead concentrations in children blood samples, high incidence in dengue and gastrointestinal diseases and high levels of polychlorinated biphenyls (PCBs) in agricultural and habitational soils (range 41 mg/kg-34,710 mg/kg). Aims: Identify, quantify and reduce environmental health risks in Alpuyeca involving the proactive participation of community, authorities and multidisciplinary team of researchers. Methods: Participatory action research (PAR) with environmental health methods (environmental sampling, biomarkers, risk assessment) and health promotion methods (coalitions buildings, PRECEDE-PROCEED model). Results: A participative space was created (CASITA) for collaboration and activities planning. Baseline study showed fecal contamination evidence (bacteria, enteric virus) founded in two wells, 3 river sampling points (recreational areas) and 20 houses. An average of blood lead levels of 7.3 µg/dl (range 1.5-36.5) in 216 children from 6 to 12 years of age, 65 % >=5µg/dl. 48% of the participating homes use cooking lead-glazed pottery, 37% has dirt floor. After prioritization the accomplished interventions were: a participatory management plan according to the potable water flow chart critical point, that allowed to estimate escapes in water supply system of the order of 40 %; workshops to reduce lead effects and visits to children with lead levels >=10 µg/dl, reducing lead levels from 14.7 to 6.8 µg/dl in this children; dengue control and good solid waste management integral intervention, reducing from 40% to 6.7% the house index and the Breteau index from 50% to 13.3%; focus groups to evaluate the PAR. Future actions: implementing the participatory water management plan, reduction of lead sources, disposal and treatment of capacitors containing PCBs, CASITAS´s survival plan. Conclusions: The ecosystem approach turns to a greater impact on complex environmental health issues.

Abstract Number	**O-3-31-01**
Presenter	Jakob Zinsstag*, Carlos Passos
Exposure	others
Health domains	other
Type of research	review

Convergence of environmental health and ecosystem health concepts, methods and practice

Environmental health, as part of public health examines physical, chemical and biological risk of the natural and build environment for human health. This includes natural and man made toxic substances like air pollutants from transport and industrial sources or chemicals in water from human activity but also natural contamination. The understanding of human exposure to environmental hazards is dealt with exposure science, of which indoor exposure is an important part of it. Environmental health uses all involved disciplines including natural and social sciences for the achievement of its goal towards a better human environment. Tremendous progress has been made in the last decades improving policy standards for air, water, radiation and noise continuously, which has led to a continuous reduction of the related burden of disease. Ecosystem health (EcoHealth) promotes linkage between health of humans and animals and ecosystem sustainability. It encourages research and problem solving that cut across many fields of scholarship (including natural, social and health sciences, and the humanities) and draws upon multiple types of knowledge. EcoHealth recognizes that health is interlinked with Social-Ecological Systems and must be addressed in conjunction to solve contemporary complex problems of health together with social, ecological and economical sustainability. Environmental health and EcoHealth have many overlapping but also distinct areas of activity. EcoHealth methodologically extends the study of health by formally addressing issues of sustainable ecosystem services. Examples of the two streams of science are presented their convergent and distinct concepts and methods are analysed in view of possible closer cooperation. Current fragmentation of science in not congruent with urgent problem solving in these fields of activity and a better cooperation strengthens the methodological approaches, improves the capacity for innovation and strengthens the political impact towards improving human and animal health while preserving ecosystem services

Abstract Number	**O-3-31-02**
Presenter	Duane Gubler*
Exposure	no exposure
Health domains	infectious diseases
Type of research	others

Dengue, Urbanization and Globalization: The Unholy Trinity of the 21st Century

Dengue is the most important arboviral disease of humans with over half of the world's population living in areas of risk. The frequency and magnitude of epidemic dengue have increased dramatically in the past 40 years as the viruses and the mosquito vectors have both expanded geographically in the tropical and sub-tropical regions of the world, creating significant social, economic and public health challenges. Many environmental factors have contributed to this emergence of epidemic dengue, but only three have been the principal drivers: 1) urbanization, 2) globalization and 3) lack of effective mosquito control. The dengue viruses have fully adapted to a human-Aedes aegypti-human transmission cycle in the large urban centers of the tropics, where crowded human populations live in intimate association with equally large mosquito populations. This setting provides the ideal environment for maintenance of the viruses and the periodic generation of epidemic strains, posing a potentially significant risk to public health. Additionally, these cities all have modern airports through which 10s of millions of passengers pass each year, providing the ideal mechanism for transportation of viruses to new cities, regions and continents where there is little or no effective mosquito control. The result is epidemic dengue. This paper will discuss this unholy trinity of environment drivers (urbanization, globalization and lack of effective vector control methods) and their impact on public health, along with brief updates on dengue vaccine and drug development, options for mosquito control, and prospects for the future.

Abstract Number	**O-3-31-03**
Presenter	Changhui Liu*, Nguyen Viet Tung, Karina Y.H. Gin, Victor W.C. Chang
Exposure	persistent organic pollutants
Health domains	other
Type of research	exposure measurement

Occurrence and ecotoxicity of PFCs in marine environment of Singapore

Perfluorinated compounds (PFCs) are a newly emerging class of environmental contaminants which are widely used in numerous applications, mainly as surfactants. The concern of PFCs rises because of their ubiquitous distributions in the environment, biota and even humans worldwide. They are also extremely persistent, bioaccumulative and can be biomagnified through the food web. Previous occurrence studies showed that PFCs can be detected at several tens ng/L to µg/L levels in Singapore's surface water. The purpose of current study was to characterize the occurrence and toxicological effects of PFCs in indigenous mussel specie, Perna viridis, in the tropical marine environment in Singapore. Mussel samples were taken around Singapore coastline. The concentrations of PFCs were measured using LC MS/MS. The ecological impact of several dominant PFCs was examined by measuring three different biomarkers, named neutral red retention time, DNA fragmentation and filtration rate. Results showed also PFCs occurred at very low level in seawater at several pg/L, green mussels however were shown to bioaccumulate PFCs to a much higher level that caused adverse responses in the organism. These biomarker responses can be used as an early warning signal to protect ecosystem health in tropical urban waters. Considering the possible risks of PFCs to the ecological system, preventive actions should be taken to regulate PFCs contaminations in Singapore.

Abstract Number	**O-3-31-04**
Presenter	Jin Zhou*, Victor W.C. Chang, Christian Zwiener, Christina Schmalz, Anthony G. Fane
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Health Risk Evaluation of Disinfection By-Products (DBPs) for Indoor Swimming Pool Users via Life Cycle Impact Assessment Approach

Due to continuous disinfection and constant organic load from swimmers, indoor swimming pools constitute environments with high levels of DBPs in water and air, some of which are linked to human health concerns. The purpose of this study is to customize current global-scale or continental scale life cycle human health impact assessment models to indoor swimming pool applications and subsequently use the model to compare different operation scenarios, which can provide relatively straight forward ideas for possible mitigation strategies. A comparison study is carried out between “baseline” scenario and four specific ‘what-if’ scenarios (using alternative disinfectant, reducing precursors, increasing ventilation, and changing characteristics of the air-water surface). We build the indoor-scale model based on USEtox, the consensus environmental model for characterisation of human and ecotoxicological impacts in Life Cycle Impact Assessment (LCIA). The model estimates the potential health risks for adults and children for 20 years during which age-specific intake factors change over time. The primary results indicated the impact from inhalation dominates the overall human health impact, while the dermal adsorption during swimming also makes significant contribution. The chloroform and trichloramine are identified as major stressors for inhalation human impact, while chloroform for dermal absorption impact. Through the scenario comparison, improving the ventilation of indoor swimming pools is an effect way to reduce the human health impact for all subjects. Another promising method is to control the precursors through increasing freshwater exchange, especially for the heavily-used pools. This study implies the choice of mitigation strategies should depend on the function and operation time of the pool. Through incorporating the proposed life cycle human health impact assessment model to the cradle-to-grave life cycle assessment studies, a systematic and comprehensive environmental profile of indoor swimming usage can be available.

Abstract Number	**O-3-31-05**
Presenter	Rosemary Zaleski*, Hua Qian, Chris Money
Exposure	organic compounds
Health domains	other
Type of research	exposure modeling

Specific Consumer Exposure Determinants (SCEDs) for Fuel and Lubricant Scenarios

Under REACH, classified substances produced in more than 10 tons per year require the development of exposure scenarios to ensure the safe use conditions of the substance and, further, communicate these conditions in the supply chain. The European Centre for Ecotoxicology and Toxicology of Chemicals Targeted Risk Assessment tool (ECETOC TRAv2) is a preferred screening tier exposure model for REACH, to assist in identifying safe use conditions. Consistent with REACH, the TRA is intentionally parameterized with conservative defaults for a broad range of consumer product uses. Because of the inherent conservatism of REACH process, much industry effort has been dedicated to better understanding consumer exposure determinants and strengthening the documentation and public availability of information supporting their basis. As part of the revised TRAv3 (released in 2012), ECETOC developed the concept of Specific Consumer Exposure Determinants (SCEDs) to facilitate the delivery of more realistic estimates of consumer exposure. The SCED enables industrial sector groups and trade associations to use available information on consumer use habits and practices to further refine the consumer exposure estimate for the product/substance. Based on recent public data, we have developed 9 SCEDs to cover a range of consumer fuel use scenarios and 4 SCEDs to better describe consumer lubricant use scenarios. The changes to the TRA defaults in these SCEDs help to more accurately describe current consumer uses in practice while retaining a conservative approach to the assessment of risk presented by each scenario. This development is being extended to compile a library of SCEDs, which then has a capability to better describe the nature of current consumer exposures through various tools such as ECETOC TRA and the European Chemical Agency’s Chemical Safety Assessment and Reporting tool (CHESAR).

Abstract Number	**O-3-31-06**
Presenter	Margherita Ferrante, Chiara Copat, Caterina Ledda*, Alfina Grasso, Giovanni Arena, Gea Oliveri Conti, Salvatore Sciacca
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Air pollution impact assessment in the area surrounding the industrial settlement of Priolo/Augusta (Italy): A multidisciplinary approach.

Background. During the past years air pollution impact on environment and health in areas surrounding industrial sites has received an increasing attention in order to prevent or minimize adverse effects or clean-up compromised ecosystems. The measurement of pollutants emissions into the environment by chemical analysis provide little information on the toxicological activity of the contaminants. Biological monitoring assesses the effects of air mixtures on reactive organisms, highlighting the interactions among individual compounds. Exposure to air pollutants causes adverse effects both on environment, agriculture and human health. Aim. In order to evaluate the impact of atmospheric pollutants emitted by the industrial settlement of Priolo/Augusta (Italy) heavy metals (Pb, Cd, As, V, Hg, Rh, Pd, Pt, Ni) levels in air were monitored in the year 2010 and Vibrio fischeri test was used to appraise airborne pollutant ecotoxicity. Method. Sampling and determination of heavy metals was performed according to UNI EN 14902. From filtres it was made an aqueous suspensions and measured the ecotoxicity (EC50 values) of samples. Statistical analysis is made by R software. The inhibition levels and effective toxicity concentrations of these samples and solutions were determined. Interactive toxicity effects among the metals were investigated. Results. Pb, Cd, As and Ni were found in trace amounts but always below law limits 155/2010. Hg, Rh, Pd and Pt were always below the detection limit. The impacts of the single heavy metal solutions were compared with each other, a toxicity ranking of Cd>Pb>As>V>Ni was obtained in order of decreasing severity. The total effective concentrations of these five metals were in the ranges of 0.094–0.543 μg/mc. The interactive toxicity effects of the heavy metals in samples were classified as antagonistic. Conclusion. High levels of heavy metals may constitute an important input in the biochemical cycle and may have significant impacts, but our findings are not considered concern for human health.

Abstract Number	**O-3-33-01**
Presenter	Tanja Wolf*
Exposure	climate change (temperature)
Health domains	healthrelated quality of life
Type of research	others

Protecting health from climate change- what has been done?

Background: The WHO European Regional Framework for Action "Protecting health in an environment challenged by climate change" aims to protect health, promote health equity and security and provide healthy environments in a changing climate in the 53 Member States of the WHO European Region. The Fifth Ministerial Conference on Environment and Health in Parma 2010 welcomed the Framework and recommended that its approaches are used to support action to protect health from climate change. Aims: To monitor the implementation of the Framework for Action, to understand the needs and priorities of countries and to collect and share examples of good practice. Methods: Those countries of the WHO European Region that have nominated a member to the Working Group on climate change and health (HIC) were invited to fill a detailed questionnaire on the implementation of the Framework for Action in summer 2012. The questions addressed the action points around eight thematic areas as suggested in the Regional Framework for Action. A quantitative evaluation scheme was applied to the answers, analyzing the replies for each topic area. The detailed qualitative information was used to extract examples of good practice in the countries. Results: 20 out of 30 countries replied in detail to the questions and interesting detail on action integrating health issues in all climate change mitigation and adaptation measures, strengthening health, social welfare and environmental systems and services; developing and strengthening early warning, surveillance and preparedness systems for extreme weather events and disease outbreaks; educational and public awareness programmes; reduce the health sector's greenhouse gas emissions and encouraging research and development. Conclusions: The quantitative and qualitative analysis highlight national achievements in protecting health from climate change for 20 countries.

Abstract Number	**O-3-33-02**
Presenter	Martin-Immanuel Bittner*, Franziska Matthies, Dafina Dalbokova, Bettina Menne
Exposure	climate change (temperature)
Health domains	policy
Type of research	others

Is Europe prepared for the next big heatwave?

Background: Extreme weather events such as heat-waves are projected to increase in intensity, duration, and frequency alike. Adverse health effects include excess mortality from a variety of causes, heat-stroke and heat illness. In the EuroHEAT project, a framework for the national and sub-national development of heat- health action plans has been developed.Aims: In this paper we assess the level of policy development and implementation in WHO European Region Member States to prevent the health effects of heat-waves.Methods: Data were collected by directly contacting national agencies, national representatives of the European working group on climate change and health (HIC), WHO country offices, scientists in the respective field as well as consulting the literature and websites. A composite index was developed, based on eight essential elements as to assess the degree of policy comprehensiveness and the extent of its implementation.Results: 51 European countries were included in the evaluation. Results show that 18 countries have implemented heat-health action plans to a varying degree of comprehensiveness, whereas 33 countries have not. Only three countries have described into detail all eight core elements. 12 European countries have developed most core elements. The core elements “indoor heat reduction”, “urban planning” and “real-time surveillance” are showing the highest gaps in implementation. However, the first two are partly covered by other agencies and sectors and may thus not necessarily be described in the heat specific action plan. Evaluation of effectiveness remains problematic.Conclusions: Systematic and harmonized evaluation of effectiveness is essential to improve existing plans and provide urgently needed evidence for the development of plans in other countries. Particularly the inclusion and implementation of long term measures needs to be stressed and underlines the importance of intersectoral collaboration. Exchange of experiences and lessons learnt can accelerate and improve this process substantially.

Abstract Number	**O-3-33-03**
Presenter	Shakoor Hajat*, Zaid Chalabi, Paul Wilkinson, Bob Erens, Benjamin Ritchie, Lorelei Jones, Catherine Heffernan, Nicholas Mays
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Evaluation of Health-Related Impacts of the National Cold Weather Plan for England

Background In order to address the large wintertime health burden experienced in England each year, the Government introduced in 2011 a Cold Weather Plan (CWP) which provides advice to relevant organisations and the general public on the protection of vulnerable individuals during cold weather. Aims This study aims to inform the CWP by characterising historic weather-health relationships and their trends over time. This information will be used to predict the impact on health and health services of particular types of adverse winter weather, and will provide a baseline to look at the impacts since implementation of the CWP. Methods Time-series regression analysis of daily mortality, emergency hospital admissions, and accident and emergency visits linked to weather data for each region of England. Simulation modelling will then be used to characterise the probability distributions of various forms of extreme winter weather events and associated health-related impacts to inform understanding of the likely costs and benefits of CWP implementation in different situations. Results Exposure-response functions, region-specific thresholds, and the impact of episodes of severe cold and adverse weather conditions will be presented. Comparison of observed impacts post-implementation with expected impacts based on past relationships will provide early evidence of the effectiveness of the CWP. Conclusions The CWP has the potential to reduce cold-related health impacts and health services usage.

Abstract Number	**O-3-33-04**
Presenter	Rachael Purcell*, Associate Professor Joe McGirr
Exposure	climate change (temperature)
Health domains	policy
Type of research	cross-sectional study

Preparing Rural GPs and health services for climate change and extreme weather

Background Rural communities are vulnerable to the health impacts of climate change, particularly in Australia. Rural General Practitioners (GPs) are critical to the development of adaptation strategies for climate change. The importance of their role warrants an investigation of their knowledge and recommendations. Aims To determine rural Australian GP attitudes towards climate change and health; and to assess their views on rural health service preparedness and strategies to improve such preparedness. Methodology A descriptive survey of GPs was conducted in Southern NSW via the Murrumbidgee Medicare Local and Coast City Country General Practice Training organizations. Results There were 68 participants. While the majority of respondents agreed with statements supporting climate science and the impact of climate change on health, a proportion did not. A significant proportion of GPs working in RRMA 5-7 identified that they did not think that their health service had the capacity to provide an initial response to an extreme weather event ($p=0.01$). 61% of participants nominated strengthening health service acute disaster capacity response as a preferred adaptation strategy for improving health service preparedness. A significant number of GPs were more supportive of their role as advocates on general health issues compared to extreme weather events or climate change and health ($p<0.01$). Older participants were significantly less supportive. 71% preferred a locally based workshop or seminar for professional development and education. Conclusion The study highlights the need to work closely with General Practitioners on the possible health effects of climate change. Findings indicate concern for health service preparedness, particularly in smaller rural communities. Development or communication of disaster response planning is needed.

Abstract Number	**O-3-33-05**
Presenter	Robert Davis, Michael Saha, David Hondula*
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	cross-sectional study

Heat-related Mortality Displacement in U.S. Cities

Background Although the near-term mortality response to extreme heat events or heat waves has been thoroughly examined, in the days and weeks following that heat impact, mortality often falls below background levels. This “mortality displacement” response is poorly understood but could impact net mortality estimates. Aims We examine the geographic variation of the relationship between mortality displacement and heat intensity in seven U.S. cities. Methods All-cause mortality and weather data were compiled for Atlanta (Georgia), Boston (Massachusetts), Minneapolis-St.Paul (Minnesota), Philadelphia (Pennsylvania), Phoenix (Arizona), Seattle (Washington) and St. Louis (Missouri) over periods of 14–26 years. We employed a generalized additive model with smoothing splines to account for seasonal and long-term trends. We defined heat waves as three (or more) day periods when maximum daily apparent temperatures exceeded a varying threshold. The ratio of the sum of excess deaths to deficit mortality defined mortality displacement at each threshold. Results Mortality displacement decreased as a function of heat wave strength in each city. There was little evidence of a net heat wave impact (i.e. mortality displacement approaches one) for some weak heat events. At the highest apparent temperatures examined, displacement varied significantly between cities, from about 35% in Philadelphia to near 80% in Boston, but was less than one in all cases. Conclusions Mortality displacement effects following heat waves were evident and a function of event strength in all cities. Displacement should be factored into net heat wave mortality estimates to provide a more accurate assessment of actual heat impacts on human health.

Abstract Number	**O-3-34-01**
Presenter	Chit Ming Wong*, Hak Kan Lai, Hilda Tsang, Thuan Quoc Thach, Graham Neil Thomas, Kin Bong Hubert Lam, Kai Hon Alexis Lau, Jon G. Ayres, Ruby SY Lee, Anthony J Hedley, Tai Hing Lam
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term effects of fine particulate PM2.5 estimated from NASA satellite remote sensor data on mortality in an elderly cohort in Hong Kong

Background The limited available studies have suggested long-term effects of air pollution are several-fold those of short-term effects. In Asia where air quality is deteriorating fast due to increasing reliance on burning of fossil fuel for transportation and electricity generation, there are no data describing the long-term effects. Aim To assess long-term effects of PM2.5 on mortality in acohort of the older population in Hong Kong Methods This prospective cohort study included 66,820 participants aged 65 or older who were enrolled and interviewed in all the 18 government Elderly Health Centres of Hong Kong in 1998-2001 and were followed up for mortality outcomes until 2011. Their proxy exposures to PM2.5 were estimated from NASA's satellite surface extinction coefficients at 1x1 km2 resolution at their geo-coded residential address. Cox regression models using time on study as timescale were fitted to assess the hazard ratios (HR) of mortality associated with PM2.5 adjusted for potential confounding factors. Results The proxy exposures of individuals to PM2.5 (µg/m3) ranged from 21.5 to 63.9 with an inter-quartile range of 32.6 to 38.2 and a median of 35.0. The excess risks (i.e. HR-1) in percentage (%) (95% CI) of mortality associated with 10 µg/m3 increase in PM2.5 for all-natural causes [ICD10:A00-R99; n=17,599] and cardiorespiratory diseases [I00-I99, J00-J47; n=8,532] were 6.3 (2.5, 10.0) and 8.3 (2.8, 13.8), respectively. Concentration-response relationships were observed particularly in all-natural cause mortality with excess risks at the 2nd- 4th quartile relative to the 1st quartile of 1.4 (-4.2, 4.6), 2.9 (-1.5, 7.5) and 5.0 (0.5, 9.7), respectively. Conclusions Estimates of long-term health effects of air pollution in Hong Kong, the most urbanized Chinese city in Asia, are comparable with those from North America and Europe. The results will provide important but much overdue information for proper air quality management and effective risk communication. Acknowledgement We thank Wellcome Trust for fnding of this study.

Abstract Number	**O-3-34-02**
Presenter	Johanna LEPEULE, Augusto A. Litonjua, Petros Koutrakis, Brent A. Coull, David Sparrow, Pantel S. Vokonas, Joel D. Schwartz*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Air pollution is associated with stronger lung function decline in the elderly

Background Air pollution exposure has been associated with lung function decline. However, this has rarely been examined in the elderly and pathways and sources of susceptibility are still poorly understood. Aims We investigated the effects of long-term exposures to black carbon and particles <2.5µm (PM2.5) on lung function decline and examined whether this association was modified by age. Methods Between 1995-2011, 889 men living in the Boston area underwent spirometry every 3-5 years (2410 visits). Exposure to air pollution within a year before each spirometry was estimated by a land-use regression model for black carbon and by a model based on satellite aerosol optical depth measurements for PM2.5. We used linear mixed models adjusted for age (at baseline and since baseline), height, weight, race, education, smoking status, pack-years, and season. Results Participants were 73.1±7.4 years-old on average. Mean ± SD forced expiratory volume in one second (FEV1) was 2.5±0.6. Mean exposure to black carbon before spirometry was 0.7±0.3 µg/m3 and 10.7±1.2 µg/m3 for PM2.5. The annual rate of decline of FVC and FEV1 increased by 0.8% (95% Confidence Interval (95%CI) 0.7%; 0.9%) and 0.7% (95%CI: 0.6%; 0.9%) respectively per each 0.5ug/m3 increase in black carbon concentration. The annual rate of decline in FVC and FEV1 per each 0.5ug/m3 increase in black carbon was significantly ($p<0.05$) greater in subjects aged over 65 years (-0.9% (95%CI: -1.0%;-0.8%) and -0.8% (95%CI: -1.0%;-0.7%), respectively) compared to people 65 years old or lower (-0.7% (95%CI: -1.0%;-0.8%) and -0.6% (95%CI: -0.8%;-0.4%), respectively). Conclusion Increased exposure to black carbon worsens the age related decline in lung function. These effects are greater in subjects aged 65 years or more, a population with lower reserve capacity.

Abstract Number	**O-3-34-03**
Presenter	Christine Autenrieth*, Regina Hampel, Kathrin Wolf, Josef Cyrys, Angela Döring, Rob Beelen, Göran Pershagen, Annette Peters
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Long-term Exposure to Air Pollution and Risk of Multimorbidity among the Elderly: Results from the KORA-Age Study

Background: Long-term exposure to air pollution is suggested to have adverse health effects on several chronic diseases. However, studies on the association between air pollution and multimorbidity are lacking. Aim: To investigate the relation between air pollution and multimorbidity among the elderly. Methods: Applying land use regression models within the ESCAPE (European Study of Cohorts for Air Pollution Effects) project, the yearly average concentrations of NO2, PM10, PM2.5, PMcoarse, and PM2.5abs were estimated at the residential addresses of 3,661 individuals aged 65-94 years who participated in the 2008/2009 KORA-Age Study in Augsburg and two adjacent counties. Multimorbidity was defined as having ≥2 chronic conditions potentially related to systemic inflammation (heart disease, stroke, diabetes mellitus, hypertension, joint disease, kidney disease). Multivariable logistic regression was used to examine the association between air pollution and multimorbidity. Results: Multimorbidity was prevalent in 38.1% participants, and the mean age of the study population was 73.3 (±6.0) years. The risk of multimorbidity (% change; 95% CI) was significantly associated with a 10 µg/m³ increase in NO2 (36.8; 12.2-66.8) and PM10 (53.4; 12.6-109.1) after multivariable adjustments. These associations were not modified by sex, smoking, BMI, education, residential area or physical activity (p-value for interaction>0.05). However, when analyzing the six chronic diseases separately, only the association between stroke and PM10 remained significant (p=0.045). Conclusion: Long-term exposure to NO2 and PM10 was associated with multimorbidity among the elderly. In view of global population aging and the chronic disease burden that is associated with increasing life expectancies around the world, it is imperative to further investigate the role of ambient air pollution in the development of multimorbidity.

Abstract Number	**O-3-34-04**
Presenter	Esmée Bijnens*, Nicky Pieters, Harrie Dewitte, Bianca Cox, Bram Janssen, Nelly Saenen, Evi Dons, Maurice P Zeegers, Luc Int Panis, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Host and environmental predictors of exhaled breath temperature in the elderly

Background Exhaled breath temperature has been suggested as a new method to detect and monitor pathological processes in the respiratory system. The putative mechanism of this approach is based upon changes in the blood flow. So far potential factors that influence breath temperature are not studied in the general population. Methods The exhaled breath temperature was measured in 151 healthy non-smoking elderly (aged: 60-80 years) at room temperature with the X-halo device with an accuracy of 0.03°C. We related exhaled breath temperature by use of regression models with potential predictors including: host factors (sex, age) and environmental factors (BMI, physical activity, and traffic indicators). Results Exhaled breath temperature was lower in women than in men and was inversely associated with age, physical activity. BMI and daily average ambient temperature were positively associated with exhaled breath temperature. Independent of the aforementioned covariates, exhaled breath temperature was significantly associated with several traffic indicators. Residential proximity to major road was inversely associated with exhaled breath temperature: doubling the distance to the nearest major intense road was observed a decrease of 0.17°C (95% CI: -0.33 to -0.01; p=0.036). Conclusion Exhaled breath temperature has been suggested as a noninvasive method for the evaluation of airway inflammation. We provide evidence that several factors known to be involved in proinflammatory conditions including BMI, physical activity and residential proximity to traffic affect exhaled breath temperature. In addition, we identified potential confounders that should be taken into account in clinical and epidemiological studies on exhaled breath temperature include sex, age, and ambient temperature.

Abstract Number	**O-3-34-05**
Presenter	Tzu-I Sung*, Yu-Han Cheng, How-Ran Guo
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Effects of air pollution and meteorological factors on long-term institutional care of elderly people in Tainan City, Taiwan

Background: Knowledge to understand the adverse health effects of air pollution have a rich history and been proven in substantial health studies and large-scale surveys. Objectives: This study is an attempt to use the epidemiological approach to investigate the health impacts of air pollution and meteorological factors on cardiovascular and respiratory disease among demented people in the long-term institutions in Tainan City, Taiwan. Methods: The daily air pollutant measurements retrieved from Taiwan EPA monitoring stations contain levels of SO2, NO2, CO, PM10 and O3. Daily meteorological data, including temperature, humidity, precipitation amounts, barometric pressure, wind direction, and wind speed, were provided by the Central Weather Bureau (CWB) of Taiwan. The medical records demented elderly people, including gender, age, diagnosis, and disposition, were claimed by several major long-term institutions in Tainan City during the period January 1, 2010, to December 31, 2012. Time-series analysis and generalized linear mixed model (GLIMMIX) were used to evaluate the short-term impacts of five primary pollutants and lag effects on daily morbidity and mortality for cardiovascular and respiratory disease, adjusting for calendar month and meteorological covariates. Results: The levels of PM10 appeared to be associated with morbidity risks of cardiovascular disease for both genders, especially for the elderly in cold weather. However, respiratory disease were more likely to happen in the population aged 65 and older who were found to be more susceptible to the extremely high O3 concentration (99th percentile). Conclusions: Daily air pollutant levels were associated with increases of incidence for cardiovascular and respiratory disease for those aged 65 and over in long-term institutions, highlighting the need for precautionary measures. Key words: air pollution, cardiovascular disease, respiratory disease, long-term institutional care, time-series, epidemiology

Abstract Number	**O-3-35-01**
Presenter	Johan Bierkens*, Tine Fierens, Mirja Van Holderbeke, Christa Cornelis, Arnout Standaert, Luc Int Panis
Exposure	biomarker
Health domains	other
Type of research	exposure modeling

Demonstration and exploitation of the 2-FUN human exposure model identified as a promising tool derived from EU research activities; A case study on Arsenic

Background Human health risk assessment and management of chemicals is a major concern for policy and industry and ultimately benefits all citizens. Exposure assessment is generally considered to be the weakest point, because current tools: (a) lack an integrated approach for assessing combined stressors, (b) often use ‘worst-case’ scenarios leading to over-conservative results, (c) lack uncertainty/sensitivity tools allowing the identification of risk drivers. To overcome these drawbacks, the FP6 project 2-FUN developed a prototype software package containing a library of models for exposure assessment, coupling environmental multi-media and PBPK models. The FP7 funded 4-FUN project aims at the demonstration and exploitation of this prototype software. Transfer to stakeholders will guarantee its long term viability. Case studies on actual datasets for both organic and inorganic pollutants will be performed to validate the 2-FUN tool. We report on a case study on inorganic arsenic pollution due to past emissions by non-ferrous smelters in Northern Belgium. Methods The following datasets are available for validation: (i) biomonitoring data on As in urine from adults; (ii) data on population behaviour (diet, activity patterns, etc); (iii) As levels in homes and public places in air, dust, soil, well water and local food products. The biomonitoring campaign enrolled 1217 adults aged 19 to 79 years, recruited in the study and reference areas. Based on these measurements, an exposure scenario will be developed to estimate the external As exposure and subsequent levels in urine. Model simulations will be compared to past evaluations (e.g. Standaert et al. 2009 Epidemiology 20;6: 53-54). Conclusions The objective of the current research is to improve the reliability of the 2-FUN modelling tool through comparison with actual measurements and to demonstrate how uncertainty margins can improve risk governance for realistic exposure scenarios satisfying the needs of stakeholders.

Abstract Number	**O-3-35-02**
Presenter	Rebecca K. Moos, Marike Kolossa-Gehring, Petra Apel, Jürgen Angerer, Thomas Brüning, Holger M. Koch*
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	exposure measurement

Parabens and other phenols in urine samples of the German Environmental Specimen Bank (ESBHum) from 1995 to 2012: a retrospective exposure assessment

Because of the ubiquitous presence and the extensive use of parabensand other phenolic substances (like triclosan, triclocarban or benzophenones) in personal care and consumer products, food and beverage processing, pharmaceuticals and disinfectants humans are constantly exposed to these substances. Some of these substances are suspected to affect the endocrine system of humans. The German Environmental Specimen Bank (ESBHum) – supervised and scientifically coordinated by the German Federal Environment Agency (UBA) – archives human specimens since 1985 and thus allows assessing trends of human exposure. We quantified the body burden to these substances (9 parabens and 6 other phenolic substances) by analyzing 660 urine samples of the ESBHum (24h-urines) from the years 1995, 1997, 1999, 2001, 2003, 2005-2009 and 2012; 60 samples per year, from 30 male and 30 female volunteers (age: 21-29 years). We applied a newly developed highly sensitive on-line HPLC-MS/MS method, for the determination of these substances in urine. Analytical limits of quantification were in the range from 0.5 to 2 µg/L. The total concentration of the analytes (free and conjugated species) was measured. All samples were blinded before analysis. In nearly all samples parabens could be quantified.Median concentrations over the different years were around 40 µg/L for methyl-, 2 µg/L for ethyl- and 5 µg/L for n-propyl paraben. For the parabens this mainly reflects their consumption volume being highest for methyl paraben, followed by ethyl-, propyl- and butyl paraben. Triclosan was detected in around 60% of all samples analyzed. Median benzophenone-3 levels fell from around 2.5 µg/L (1995-2003) to < LOQ (2005-2012). For all other analytes medians are below the LOQ. Over the years we observed rather constant levels of exposures, except for the decrease in benzophenone-3. This retrospective study provides first data on internal exposures to the above substances in Germany from 1995 till 2012.

Abstract Number	**O-3-35-03**
Presenter	Randi Bertelsen*, Stephanie Engel, Todd A. Jusko, Antonia M. Calafat, Jane Hoppin, Merete Eggesbø, Heidi Aase, Paal Zeiner, Ted Reichborn-Kjennerud, Virginia Guidry, Matthew Longnecker
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Reliability of triclosan in repeated urine samples from Norwegian women

Background:Triclosan (TCS) is an antibacterial chemical that is used in personal care products and is measurable in urine. TCS has a short half-life, and body burden is mainly influenced by the individual's use of TCS-containing products. Exposure to TCS has been associated with allergic disease in some studies, but knowledge about temporal variability of biomarkers of exposure to TCS is limited. A study of 6-10 year old US children found a reasonable degree of temporal reliability for TCS, but TCS reliability has not been examined among adults. Aims: To examine whether TCS concentrations in urine from gestational week 17 were consistent across later time points in pregnancy. Methods:Spot urine samples were collected in gestational weeks 17, 23, and 29 from 45 women in The Norwegian Mother and Child Cohort Study (MoBa). TCS was measured by online solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry. Spearman's rank correlation coefficient (rs) and intraclass correlation coefficient (ICC) statistics were calculated. For concentrations below the assay's limit of detection (2.3 µg/L) we used the instrumental reading values. The ICC was calculated using natural log transformed TCS values. Results: Overall, only 36% of the values (48/135) were detectable; 56% of the women had a least one detectable value, and 20 women had undetectable TCS concentrations in all three urine samples. The 95th percentile of TCS in the 135 urine specimens was 351 µg/g creatinine. The correlation for TCS concentrations between gestational weeks 17 and 23 was rs=0.69, and the correlation between weeks 17 and 29 was rs=0.49. For the three time points, the ICC was 0.49 ($p<0.001$). Conclusions: The reliability of TCS in repeated urine samples from pregnant women was reasonable, suggesting a single urine sample may be adequate in representing TCS exposure during pregnancy.

Abstract Number	**O-3-35-04**
Presenter	Alexi Ernstoff, Susan Csiszar, Olivier Jolliet*
Exposure	biomarker
Health domains	no health domain
Type of research	exposure modeling

Consumer exposure to parabens within cosmetics compared with population-scale urinary biomarkers

Background The US National Health and Nutrition Examination Survey (NHANES) measures population-scale urinary biomarkers of many chemicals, for example parabens, which are often used in US cosmetics and may be harmful. Aims We aim to develop methods to consistently predict cosmetic chemical exposure and corroborate these predictions with urinary biomarkers. Methods A potential dose of several parabens, i.e., Dex [g-chemical/kg-bodyweight/day-of-use] is estimated by considering the fractions of chemical within and across cosmetics, the mass of cosmetic applied (e.g. ~4.5 g/day of lotion), and the product intake fraction calculated based on skin permeation of the chemical. Tests are performed to compare Dex with NHANES urinary biomarker data with and without considering the fraction excreted through urine (fue). Results When dose is adjusted by using the fraction of cosmetic products that typically contain each respective paraben, Dex_adj , it correlates well with urinary biomarkers for the 95th percentile of tested women (R2 = 0.99, n = 4). For instance, methylparaben is the most commonly used paraben in cosmetics and the highest concentration in urine. This correlation, however, does not provide absolute dose values. When fue is applied as a correction factor to back-calculate dose from the population geomean urinary biomarker data, it correlates well (R2 = 0.92, n=4) to Dex_adj and approaches the 1:1 line. Likewise, when the fue is applied as a correction factor to Dex_adj, the correlation with the general population's geomean urinary levels remains high (R2=0.72, n=4), and the equation approaches the 1:1 line. Conclusions The fraction of cosmetics on the market containing a given chemical is important to understand population-scale exposure, especially for high-end users (95th percentile for women). When estimates of exposure are combined with estimates of urinary excretion fractions, doses for high-end consumers may be better estimated and are correlated well with general population NHANES urinary biomarker data.

Abstract Number	**O-3-35-05**
Presenter	Jonathan Thornburg*, Seung-Hyun Cho, James Raymer, Fuyuen Yip, Tegan Boehmer, Marjorie Hinsdale-Shouse, Lisa Thalji, Diane Wagener
Exposure	biomarker
Health domains	respiratory disease
Type of research	exposure measurement

The Effectiveness Environmental Measurements and Biomarkers of Exposure at Minimizing Exposure Misclassification

Background: Children's Health after the Storm (CHATS) is a cohort study investigating adverse health effects among children who resided in areas affected by Hurricanes Katrina and Rita in the U.S. A feasibility study is underway. Aim: One study aim is to assess ways to minimize exposure misclassification bias. We hypothesize that personal measurements of environmental exposure have a stronger association with biomarkers of exposure than do indirect exposure measurements. Methods: A substudy of 100 children will assess exposure misclassification. For each child, we are collecting: 1) one-week measurements of personal exposure to particulate matter (PM10), second-hand smoke (SHS), and volatile organic compounds (VOC); 2) one-week residential indoor and outdoor stationary sampling for the same pollutants; and 3) corresponding urinary biomarkers of exposure. We will compare personal exposure data to indoor and outdoor residential data, and environmental SHS and VOC measurements to urinary cotinine and VOC metabolite concentrations. Results: Data from 50 children show that personal exposures to PM10 (mean: 38 mg/m3, GSD = 2.4) exceed the indoor (mean: 25 mg/m3, GSD = 2.4) and outdoor concentrations (mean: 20 mg/m3, GSD = 1.8), with SHS being a key source of the difference. Personal and indoor VOC concentrations are similar (mean: 0.015 mg/L, GSD = 2.1) and are greater than outdoor concentrations (mean: 0.005 mg/L, GSD = 1.9). Additional environmental and biospecimen sample collection and analysis are ongoing and will be presented. Conclusions: Preliminary data suggest that personal measurements are best at minimizing exposure misclassification bias. Strong sources within microenvironments and the child's proximity to these sources are the most likely causes. The correlation between the personal measurements and the urinary VOC and cotinine biomarkers will confirm this supposition. Our assessment of approaches to minimize exposure misclassification will be fully evaluated to inform the Full Study Phase of CHATS.

Abstract Number	**O-3-36-02**
Presenter	Mona Loraine Barabad*, Duck Shin Park, Kyung Hwan Park, Do Yeon Hwang
Exposure	others
Health domains	healthrelated quality of life
Type of research	others

A Study of Indoor Air Quality during cooking activities in the Philippines

Abstract Indoor Air Quality has gained a lot of attention due to its heightening issues in numerous countries over the years. Unfortunately, Philippines are not fully aware about it since there weren't many data related to the subject. In order to identify and introduce the topic, few tests were carried out in 2 different sampling areas, one from a residential house and a Filipino restaurant. Charcoal and liquefied petroleum gas (LPG) were used as a cooking fuel, respectively. VOC concentrations were detected by a gas chromatography with mass spectrometry and a dust spectrometer for PM10. The analysis showed that using charcoal for cooking can result a higher TVOC (6,688.30 μg/m3) than the restaurant's LPG (922.76 μg/m3), it was also shown that toluene and benzene were the common compound that observed during cooking. In addition, PM10 levels were also higher in the house (265±208 μg/m3) comparing to the latter (56±23 μg/m3), which has a background concentration of 19-23 μg/m3 and 21-25 μg/m3,accordingly. Although higher concentrations were found, most of the people still have limited knowledge about the risk of high level of exposure from the chemicals. Imparting knowledge about IAQ is necessary to help regulate the proper usage of different cooking fuels.

Abstract Number	**O-3-36-03**
Presenter	Jungyun Lim, Sue-Jin Kim, Woo-Seok Lee, Jin-Seok Han, Jun-Seok Cha*
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	case-control study

Behavior of VOCs and carbonyl compounds emission from different types of wallpapers and flooring materials in Korea

Behavior of VOCs and carbonyl compounds emission from different types of wallpapers and flooring materials in Korea Jung-Yun Lim, Sue-Jin Kim, Woo-Seok Lee, Jin-Seok Han, Jun-Seok Cha* Indoor Environment & Noise Research Division, National Institute of Environmental Research(NIER), Environmental Research Complex, 42 Hwankyeong-Ro, Seo-Gu, Incheon, 404-708, Republic of Korea * E-mail : js11cha@korea.kr ABSTRACT Building materials are important sources of VOCs and carbonyl compounds in the indoor environment. Understanding the emission behavior of VOCs and carbonyl compounds from them is important to manage indoor air quality. This study evaluates VOCs and carbonyl compounds emission behaviors, using a 20 L small emission test chamber, for various kinds of solid phase building materials such as wallpapers and flooring materials. The materials used in the emission test were totally 575 pieces(wallpapers:332, flooring:243). Test samples were prepared according to ISO 160000-11 and standard test method for indoor air of Korea. TVOC and formaldehyde emission rates were higher for flooring materials than wallpapers. In the case of wallpapers, TVOC emission rate was in the order of PVC(foam-expanded) > natural paper > general paper and formaldehyde emission rate was in the order of natural paper > PVC(foam-expanded) > general paper. TVOC emission rate was about 8 times higher for PVC(foam-expanded) paper than non-PVC paper and the main detected substances were n-Dodecane and n-Tridecane. For the flooring materials, TVOC emission rate was in the order of carpet tile > PVC > wood-based panels and formaldehyde emission rate was in the order of wood-based panels > carpet tile > PVC. Especially, formaldehyde emission rate for wood-based panels was estimated as 0.047 mg/m2·h, which is much higher than carpet tile and PVC. Formaldehyde was detected at 50 products among 55, which showed more than 90% detection.

Abstract Number	**O-3-36-04**
Presenter	Chien-Cheng Jung, Hsiu-Hao Liang, Nai-Yun Hsu, Hsin-Wen Chang, Hui-Ling Lee, Yi-Ho Lee, Huey-Jen Su*
Exposure	household air pollution
Health domains	other
Type of research	cross-sectional study

Exploration for Biomarkers of Sick Building Syndrome: Feasibility Study of Allostatic Load Model

Background: Both personal and environmental factors are linked to the severity of sick building syndrome (SBS). There is, however, no particular form of assessment can serve as a comprehensive surrogate for examining SBS severity. Allostatic load model, is reported, at least, as an objective biomarker to reflect the effects of environmental or personal factors on reporting SBS. Aims: This study is to assess the feasibility of using allostatic load model to characterize the reporting of SBS, and compare the efficacy of using 8-OHdG level in urine as shown in previous studies. Methods: Bio-samples (saliva and urine) and health indicators were collected for 118 subjects, some of which were used to calculate allostatic load score. Questionnaire was used to investigate the quality of life and SBS of study subjects. The indoor environmental quality where these subjects worked was also measured (n=21). Linear regression model was used to analyze the feasibility of using allostatic load model to characterize SBS by SPSS 17.0. Statistic significant was at $p < 0.05$. Results: There was no significant association between SBS and allostatic load score, environmental and personal factors. Nevertheless, 8-OHdG levels and the scores of neuroendocrine and metabolic system included in allostatic load model were associated with relative humidity and HCHO while PM2.5 was correlated with score of immune system. In addition, status of psychological health was also significantly correlated with allostatic load score. Results indicated that allostatic load model can not only reflect the effects of environmental factors, but also take into account the personal factors. Conclusions: The study is among the first to characterize the relationship among allostatic load model, SBS, environmental and personal factors. Allostatic load model appears to be feasible for application in further clarifying what the major risk factors may be in reporting SBS.

Abstract Number	**O-3-36-05**
Presenter	Laura Brosig*, Wolfgang Horn, Lars Pyza, Oliver Jann
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Implementation of Odour Measurement in the Assessment of Building Products

Background There is evidence that odour in the indoor environment, mostly caused by materials emissions, affects human health and well-being. Furthermoreodour generally is difficult or not at all analytical detectable. The AgBB-scheme (AgBB - German Committee for Health-Related Evaluation of Building Products) assesses the suitability of the indoor utilization of building products regarding analytical detectable VOC and SVOC emissions. Considering odour emissions the AgBB intends to implement this sensory assessment into the AgBB-scheme. Aims Within a project, financed by the Federal Environment Agency (UBA), the applicability of the odour measurement procedure according to ISO 16000-28:2012 has been investigated. Test parameters like perceived intensity and the hedonic tone of air samples have been taken into consideration. Methods End of 2012 the first of two inter-laboratory tests has started with 12 participating laboratories and was supervised by BAM. As reference material cartridges with acrylic sealant where shipped along with u-shaped aluminium profiles of appropriate length for the loading of emission test chambers. The generated air samples were tested for perceived intensity by trained assessors by means of a comparison scale that provides intensity graduated odour samples. The grading allows the classification of the actual air samples on the comparison scale. Additionally the hedonic tone was assessed. Results and Conclusion The results for the perceived intensity and the hedonic tone lie within usual deviations of inter-laboratory tests and indicate that the method concerning the comparison scale is potentially applicable. For a successful operation it is at least required that the emission test chambers are operated consistently and the assessors are sufficiently experienced.

Abstract Number	**O-3-37-01**
Presenter	Asra Hosseini*
Exposure	others
Health domains	mental health
Type of research	cross-sectional study

The Association between Neighborhoods' Characteristics and Stress in Children: Evidence from Kuala Lumpur, Malaysia

Studies show the prevalence of children's stress in Malaysia is nearly 50% but it is higher compared to the WHO expected figure of health problems which is about 20%. Everyday stress in urban areas is defined as the frustrating demands that daily interaction with the environment create and the continuous experience of these stressors can affect health of the individual from childhood. Certain groups like children are more vulnerable to some of the hazards of urbanization, and now the challenge is how to grow them in ways that are healthy and environmentally sustainable as massive growth of urban population in next decades is faced in Malaysia. The main aims of this study are: 1) To construct a Children Stress Index capable of explaining variation in health on a small-scale geographic level in Malaysia. 2) To conduct a methodological review of multilevel studies, monitoring for different Socio-Economic Status to evaluate underlying mechanism through which neighborhoods affect children's stress. 3) To investigate a meta-analysis method to find the associations between neighborhoods' characteristics in different socioeconomic status with children's health stressors/all-cause stress. Qualitative and quantitative research methods implemented for this research. Data collection was from expected 500 children, 10-12 years old in Malaysia and it included standardized questionnaire (survey), interviewing, mapping through software such as AutoCAD and ArcGIS. Collected data analyse with factor group analysis method and regression model through SPSS. This study would be an attempts to focus on urban planning to recognize and moderate stress in urban children and exploring family environment and connectedness as potential mediators of stress in children and it can remarkably help to cognizing of causes and effects of children's stress in current situation and also can be implemented in the future plans of Malaysia.

Abstract Number	**O-3-37-02**
Presenter	Audrey de Nazelle*, David Donaire-Gonzalez, Edmund Seto, Michelle A Mendez, Mark J Nieuwenhuijsen, Michael Jerrett
Exposure	others
Health domains	mental health
Type of research	exposure measurement

Real time assessment of stress experienced during travel times in Barcelona, Spain, using novel smart phone technology

Background With the development of ubiquitous sensing technology, opportunities are opening up for novel research on real-time and real-life responses to stressors in the environment. Our aim was to assess levels of stress as a result of typical urban commute-time exposures. Methods We equipped 36 volunteers in Barcelona for 5 days with an Android phone fitted with CalFit to measure geo-position and physical activity, and with a Bodymedia Sensewear, which measures Galvanic Skin Response (GSR). Variables reflecting potential stressors or soothers (traffic, air pollution or greenery) at a microscale level were collected. We identified travel periods and modes and linked minute-by-minute GSR and physical activity measurements to various stressors at each geoposition. We developed generalized additive models of GSR as a function of stressors, accounting for physical activity. Results We conducted a preliminary assessment on 764 one-minute measurements from participants walking, 690 cycling, 634 in the metro, 49 in a bus, 311 on a motorcycle, and 256 in a car. Mean GSR varied from 0.074 microSiemens (µS) in the bus to 0.138 on a bike. We observed a clear, significant, positive effect of traffic on GSR while cycling. More attenuated positive effects were found for the bus and motorcycle. Walking had an overall opposite trend but not clearly unidirectional. Further work will explore various buffer sizes for stressors, effects of lag times, and statistical techniques to account for repeated measures. Conclusion We demonstrated the potential for smart phone technology to contribute to novel research on immediate health and wellbeing effects of typical stressors found in outdoor urban environments. Traffic seems to increase stress levels particularly in cyclists who are often in proximity with cars. Such information may have important implications for environmental epidemiology because of effect modifications of other environmental exposures (e.g. effects of traffic pollution on asthma are positively modified by stress).

Abstract Number	**O-3-37-03**
Presenter	Thanawit Bunsit*
Exposure	pesticides
Health domains	respiratory disease
Type of research	randomized trial

Organic vegetable farming in rural Thailand and its impacts on physical and psychological health

This study aims to assess the impact of intervention in vegetable farming on physical and psychological health of low income farmers in rural Thailand. In this study, 500 households of vegetable farmers in the South of Thailand were selected as samples for impact assessment. Vegetable is considerable economic value in many rural villages with low cost and high returns. As the market is growing, some farmers use large quantity of chemical products during their farming process to increase productivity. This leads to pollution and harmful impacts on both consumers and producers. The intervention programme, established by local people aimed to reduce the area of farming activity using chemical products, introduced organic methods for rural vegetable farmers with minimum cost and used local plants such as citronella grass, neem plant, galangal, curcuma to produce pesticides. To assess the impact of the intervention to physical and psychological health, the control group (mainstream farming) was compared to the treatment group (organic and self-helped group farming) using propensity score analysis. It was found that organic vegetable farmers reported better health condition than the mainstream farmers. The frequency of clinic visits in the treatment group was significantly lower than the control group and there was no report of respiratory disease such as asthma in the organic farming group. Concerning the psychological health impacts, it was clear that the treatment group with group working method reported a higher level of positive affects such as self-esteem, proud and active, and less negative affects including low level of stress, nervous and feelings of guilty. In conclusion, the organic vegetable group farming not only reduces the risk of illness but also helps improve positive affects for farmers. This method should be implemented in other enterprises in order to improve wellbeing of participants and build awareness of sustainable health and environment in society.

Abstract Number	**O-3-37-04**
Presenter	Poune Saberi*, Martha Powers, Judith McKenzie, Edward Emmett
Exposure	others
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Field Survey of Health Perception and Complaints of Pennsylvania Residents in Marcellus Shale Regions

Natural gas has been extracted by unconventional hydraulic fracturing in Marcellus Shale, Pennsylvania since 2004. Residents have reported health symptoms related to natural gas operations (NGO). We evaluated the perceived environmental causes of health complaints in a county exposed to NGO. The study population is residents in a Pennsylvania county where NGO are occurring. A composite questionnaire was administered to a convenience sample of adult volunteers at a primary care physician's office. The questionnaire elicited information about health symptoms previously reported by other residents in relation to NGO. It queried opinions of participants regarding their perception of environmental causes of their health problems. We measured their sense of control over health problems; geospatially mapped their home location in relation to NGO and reviewed medical records of symptomatic patients for correlation with medical documentation. Of the 159 waiting patients who were approached, 72 participated (45%). Four components were explored in the survey: the percentage of people who pick natural gas as an environmental cause of health problems (Total N=16, 22%, CI 12.5%), a review of systems to compare to what has been most commonly reported previously, medical record review to compare reported symptoms with documented symptoms (N=5), geospatial map of residences of survey-takers in relation to NGO (N=53). Of those who picked an environmental cause, 9 had current health complaints they attributed to NGO and 7 chose NGO as a potential cause. There are residents in Pennsylvania who believe NGO is the cause of their health impairments or may become so in the future. This study addresses the question of whether the physical complaints are from a selected few or represent the voice of a larger portion of community. The findings will guide research for epidemiological studies of exposures; provide a basis for health care provider education and encourage the development of a registry and investigation of all NGO related health complaints in the area.

Abstract Number	**O-3-37-05**
Presenter	Simon Kingham*, Kim Reed, Malcolm Campbell, Daniel Hogg, Tom Wilson, Mike Ardagh
Exposure	others
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Estimating the impact of earthquake exposure on stress related health; preliminary results from Christchurch, New Zealand.

BackgroundSept 4th 2010 saw the start of a series of destructive earthquakes around the city of Christchurch, New Zealand (pop 350,000). These left the region with widespread damage to the city and its infrastructure including: major liquefaction (the process by the ground turns to liquid); 70% of the central city needs to be rebuilt; 20,000 homes need to be pulled down: and 100,000 homes need repairing. The aftershocks are ongoing with over 13,000. It is hypothesised that all this will have an ongoing impact on those living in and around the city.AimsThe aims of this study were to identify whether adverse stress-related health outcomes were greater among people who have experienced greater physical damage to their communities than those who have experienced less damage, but who also live in the region.MethodsExposure to earthquake damage through amount & extent of liquefaction and land 'colour' (land is colour coded according whether it can used in the future) was estimated.Emergency department data was collated for chest pain and anxiety for a period of 6 months before and 18 months after the start of the earthquakes.Exposure was related to health.ResultsFor the period from May 1st 2010 to 30th April 2012 there were 9,807 chest pain and 524 anxiety hospital attendances.Those people living in areas of greater earthquake related damage and those living closer to more damaged areas had greater levels of stress related ill health.ConclusionsThere is preliminary evidence that those living in and nearer to areas of greater earthquake impact have greater levels of stress related ill-health.Further research will develop more indicators of earthquake impact such as: extent of home damage; infrastructure service closures and restriction, community disruption e.g. school & shop closure; extent of home damage; and magnitude of shaking. In addition population mobility will be included in future analysis.

Abstract Number	**O-3-38-01**
Presenter	Feng Xu, Shuxian Yan, Fei Li, Haidong Kan, Jinhua Xu, Zhuohui Zhao*
Exposure	household air pollution
Health domains	skin disease
Type of research	cross-sectional study

Environmental risk factors for atopic dermatitis in 6624 children aged 3-6 years old in Shanghai, China: interaction between environment and heredity

Background Atopic dermatitis(AD) is a polygenic skin disease impacted strongly by environmental triggers. There is high prevalence of atopic dermatitis in 3-6 year-old children in Shanghai, China. Aims To identify risk factors of children's AD, in relation to home environment, personal life and heredity, as well as interaction between environment and heredity. Methods A cross-sectional questionnaire survey was administered in Shanghai from April to June, 2010. It included 6624 kindergarten children(51.3% boys) in six communities(2 urban and 4 suburban/rural). AD was diagnosed based on the U.K. Working Party's criteria. Physicians served in communities were trained for AD diagnosis and questionnaire survey. All kindergarten children living in the selected communities were surveyed and parents or legal guardians answered the questionnaires. Results Overall, 8.5% of children had AD ever. There was no gender difference of AD prevalence (8.4% vs.8.6%). Around 10% of subjects reported that mothers lived in newly renovated/decorated homes(NRDH) prenatally(1year before or during pregnancy) and 9.5% ever had home new furniture(HNF) since prenatal time. By multivariate regression analyses, living in NRDH homes prenatally(odds ratio(OR)1.41, 95% confidence interval(CI) 1.03-1.93), with home indoor molds (2.00, 1.48-2.70) as well as family atopic history (3.85, 3.05-4.87), urban residency(1.52, 1.18-1.96) and food allergy(3.40, 2.63-4.40) were all significantly associated with children's AD. Living in NRDH, HNF and home indoor molds were only significant in children without family atopic diseases. An interaction effect was detected between family atopic history and NRDH($P<0.05$). Conclusions Home new renovation/decoration, new furniture and indoor molds were potential home risk factors of childhood AD in Shanghai, as well as urban residency, food allergy and family atopic diseases. Environmental factors were more of significance in children without family atopic diseases.

Abstract Number	**O-3-38-02**
Presenter	Ashwin Swaminathan*, Robyn Lucas, Matthew Cook, Keith Dear, Simone Harrison, Ketheesan Natkunam, Tony McMichael
Exposure	UV radiation
Health domains	other
Type of research	others

Solar ultraviolet radiation exposure influences the immune response to immunization: Results from an Australian clinical trial

Background Exposure to ultraviolet radiation (UVR) causes systemic immune suppression. The effect of natural levels of UVR exposure on the primary immune response to vaccination has not been previously reported. Method The Australian Ultraviolet Radiation and Immunity Study was conducted in the Australian cities of Canberra (35o2'S) and Townsville (19o1'S) from July 1010 to August 2011. Healthy volunteers (n=222) aged 18–40 years were immunised subcutaneously with keyhole limpet haemocyanin (KLH). Acute personal UVR exposure was measured by electronic UVR wrist dosimeters worn for five days pre- and post-vaccination, and by sun exposure diary. Cumulative UVR exposure was quantified by microtopographic analysis of silicone impressions of sun-exposed skin. Potential confounders were measured (e.g. serum 25-OH vitamin D). Immune function measured over a 21-day period post-vaccination included: anti-KLH IgG1 levels; KLH-specific delayed-type hypersensitivity (DTH) response; and quantification of T-helper (CD4+) lymphocyte subsets. Results In multiple regression models, higher acute UVR exposure on the day prior ('Day 5') to vaccination (p=0.015), and Days 5-8 and 5-9 (p=0.039 and p=0.025, respectively) were associated with reduced DTH response to KLH challenge at day 21 post-vaccination."Change in T-helper 17 cell percentage between pre- and post-vaccination time points differed in direction when comparing the low and high UVR exposure groups (-0.39%vs.0.31%; p=0.004). There was no association between UVR exposure and anti-KLH IgG1. 25-OH vitamin D was not associated with immune function outcomes. Conclusions Acute UVR exposures, relevant to day-to-day activities, modulates the cell-mediated primary immune responses to KLH vaccination.

Abstract Number	**O-3-38-03**
Presenter	Wei Jie Seow, Wen-Chi Pan, Molly Kile*, Andrea A Baccarelli, Quazi Quamruzzaman, Mahmuder Rahman, Golam Mostofa, Li Su, Xihong Lin, David C. Christiani
Exposure	metals
Health domains	cancer
Type of research	case-control study

Genetic Variants in One-carbon Metabolism and DNA Repair Genes Modify the Association between Arsenic and Skin Lesions in Bangladesh

Background: Chronic arsenic exposure is associated with skin lesions but the role of genetic susceptibility remains unclear. Aims: To investigate association between single nucleotide polymorphisms (SNPs) in inflammation, one-carbon metabolism and skin cancer genes and skin lesions. Methods: A case-control study was conducted in a population of 540 skin lesion cases and 400 controls in Pabna, Bangladesh in 2001. Thirty-eight SNPs were analyzed at the gene-set level for their association with skin lesions using SNP-set Kernel Association Test (SKAT) adjusting for arsenic exposure measured in water and toenails. Logistic regression was used to estimate the interaction between SNPs and arsenic on risk of skin lesions. Results: Inflammation and one-carbon metabolism gene-sets were significantly associated with skin lesions (P = 0.03), after adjusting for water arsenic and other covariates. Two SNPs rs2278952 (PEMT, P for interaction = 0.003) and rs2228000 (XPC, P for interaction = 0.005) significantly modified the association between arsenic and skin lesions after adjusting for multiple comparisons. Similar results were observed with toenail arsenic. Conclusions: Genetic variants in one-carbon metabolism and DNA repair genes influence susceptibility of arsenic-induced skin lesions.

Abstract Number	**O-3-38-04**
Presenter	Audil Rashid*, Ikhtiar Uddin, Tariq Mahmood
Exposure	biomarker
Health domains	skin disease
Type of research	occupational study

Comparison of serum PAHs levels in workers of two separate petroleum occupational exposure situations

Background: Chemical exposure biomonitoring and associated health risk assessment for petroleum related occupations are extremely neglected in Pakistan. Aims: We aimed to determine blood PAH concentrations in two petroleum related occupational groups to establish exposure effect relation with work conditions and to assess the suitability of selected PAHs as biomarkers. Methods: Workers employed at petrol-filling stations (n=48) and auto-mechanic workshops (55) were compared with a control population of maintenance workers in a university (n=52). Concentration of phenanthrene, pyrene and benzo[a]pyrene in blood samples were determined along with urinary metabolite 1-hydroxyprene levels among workers. Smoking habits and skin-related health problems were identified using a questionnaire. Results: Based on PAH levels in blood and 1-hydroxyprene concentrations in urine, the auto-mechanic workers were the most exposed. Significantly high pyrene, benzo[a]pyrene and 1-hydroxyprene levels were found in these workers as compared to people employed at petrol-filling stations and in university. No statistically significant effect of smoking was observed for control group. However, a strong positive correlation between smoking and blood phenanthrene was observed in both occupational groups. Results of logistic regression revealed that petrol-filling workers exposed to 6 hour per day or more had high prevalence of skin dryness & redness (OR=2.58, 95% CI=1.08–6.52) whereas job duration > 10years has attributed substantial development allergic dermatitis (OR=3.11, 95% CI=1.23–9.27) among auto-mechanic workers. Conclusions: Serum PAH estimates are good proxy measures of petroleum exposure at filling stations and auto workshops. Inhalation and dermal contact are key sources of exposure to PAH in petroleum occupations and can cause severe health risk in long job hour conditions. Yearly health monitoring is imperative to minimize health risks associated with PAH exposure in Pakistan.

Abstract Number	**O-3-39-01**
Presenter	Eva Andersson*, Magnus Akerstrom, Pernilla Almerud, Gerd Sallsten
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Values below limit of detection: simulations of mixed models data

Background The benzene exposure is sometimes so low that an instrument cannot detect the value, thus yielding a distribution truncated at the detection limit, DL. The missing values can be replaced by DL/sqrt(2). Another way is to use Tobit analysis, by which the parameters (expected value, variance) of the un-truncated distribution are estimated, and then computer-generate observations to replace values below DL. When repeated observations are made on the same subject, the observations are often correlated and a mixed model is used, yij=μ+bi+eij, with two variance components, Var[b]=σ2B and Var[e]=σ2e. Here, the computer-generated observations must be simulated according to this model. Aims One aim was to evaluate the Tobit estimates for up to 60% below DL. Another aim was to propose a procedure for computer-generating observations according to the structure of the mixed model. Data and methods Tobit analysis was used on benzene data from 6 groups (108 persons, 208 measurements), yielding estimates of μ and the total variance (σ2B+σ2e). The σ2e was then estimated using data from persons with two observations above DL. Observations below DL were replaced by simulated observations, generated in two steps:1) bi~ N(0; σ2B), and 2) eij~N(μ+bi; σ2e). Results The evaluation of the Tobit analysis showed that the resulting confidence interval for μ had the same width as an interval from a complete data set, for up to 30% of the values below DL (for 50% the Tobit interval was 25% wider). Replacing values below DL with computer-generated observations generally resulted in a lower expected value and a larger variance, compared to replacing them with DL/sqrt(2). Conclusions The Tobit analysis can be used to estimate μ and the total variance (σ2B+σ2e) for repeated measures with up to 50-60% of the values below DL. Computer-generating observations (rather than replacing with DL/sqrt(2)) yields a more realistic variance when the proportion of values below DL is large.

Abstract Number	**O-3-39-02**
Presenter	Sally Picciotto*, Daniel M Brown, Ellen A. Eisen
Exposure	others
Health domains	other
Type of research	others

Time-varying confounders affected by prior exposure: when do they require causal inference methods?

Background: With the increasing popularity of causal directed acyclic graphs and “causal inference methods” (also called g-methods), epidemiologists are paying more attention to time-varying confounders, particularly those affected by prior exposure. Such variables may cause bias in a standard analysis, whether or not the model adjusts for them. Aims: To clarify the situations in which causal inference methods are needed. Methods: Directed acyclic graphs help to illustrate two different scenarios that depend on the causal question of interest. In one, the exposure of interest is a cumulative measure that takes into account prior exposure history. In the other, the exposure of interest is a current exposure (measured in the same time interval as, or just prior to, the outcome), while prior exposure history is merely a confounder. Results: When the causal question of interest involves a cumulative exposure measure, causal inference methods are required because results from a standard analysis will be biased. However, when the causal question concerns a current exposure only, both causal inference methods and standard analysis should be unbiased. Conclusion: Researchers should always adjust for time-varying confounders affected by prior exposure; the causal question of interest determines which methods can achieve a correct adjustment.

Abstract Number	**O-3-39-03**
Presenter	Marc G Weisskopf*, Howard Hu, David Sparrow, Melinda Power
Exposure	others
Health domains	other
Type of research	cohort study

What you don’t see can hurt you: Selection bias in cohort studies—are environmental studies at particular risk?

Background: Selection bias is a well-recognized concern of case-control studies, but is often assumed to be avoided in prospective cohort studies. However, nonparticipation at the start of cohort studies is common. Several studies suggest certain exposure-outcome associations are only minimally biased, but this may not always be the case. Aims: To examine the influence of selection biases in cohort studies—and explaining these with Directed Acyclic Graphs—using the lead exposure-mortality association as a motivating example. Methods: We measured bone lead with K X-Ray Fluorescence (KXRF) among 836 white men (mean age 67±7) in the Normative Aging Study and examined the association with mortality over an average of 9 years of follow-up using multivariable Cox proportional hazards. We used information on all 2,159 white men initially enrolled in the NAS and inverse probability weighting (IPW) to examine the influence of selection biases on the lead-mortality association. Results: Among the 836 men, the hazard ratio (HR) for ischemic heart disease mortality for those in the highest patella bone lead tertile compared with those in the lowest was 2.01 (95% confidence interval [CI]: 0.86-4.68). In analyses restricted to the 613 men ≤45 years old at entry into the NAS (130 deaths), severely limiting cardiovascular-dependent selection bias into the NAS, the HR was 4.37 (95% CI: 1.20-16.0). The HR after IPW to account for dependent loss to follow-up from NAS entry to KXRF was 4.28 (95% CI: 1.49-12.31). This pattern of results was similar for allcause and all cardiovascular mortality, although with smaller HR. Conclusions: Non-participation strongly biased the association between lead exposure and ischemic heart disease mortality towards the null. Because socioeconomic status (SES) is often a strong predictor of cohort study participation, and many environmental toxicants have strong associations with SES, studies of health effects of environmental toxicants may be particularly susceptible to this bias.

Abstract Number	**O-3-39-04**
Presenter	Sally Picciotto*, Jonathan Chevrier, Ellen A. Eisen
Exposure	others
Health domains	other
Type of research	occupational study

Controlling for the healthy worker survivor bias with g-estimation to assess the potential benefits of reducing occupational exposure limits

Background: To prevent healthy worker survivor bias, g-estimation of an accelerated failure time model is a good analytic method for occupational cohorts with longitudinal exposure data. Although technical challenges make the method difficult to implement with quantitative exposures, it is useful for evaluating the benefits of hypothetical interventions. Aims: To assess the potential impacts on all-cause mortality of lowering the occupational exposure limit (OEL) for respirable particulate matter (PM3.5) composed of metalworking fluid to a series of different values. Methods: For each OEL value, we used g-estimation to calculate the total counterfactual years of life saved by an intervention in which annual exposure was not permitted to exceed the OEL. The years of life saved by each intervention were computed relative to the observed outcomes, which were common to all cutoffs. Because the effect measure in each analysis relates counterfactual outcomes under an intervention to observed outcomes under no intervention, results from the different cutoffs may be compared. Results: Beginning with a PM3.5 cutoff of 0.15mg/m3, the impact of the intervention progressively increased as the cutoff approached 0. For example, the interventions that allowed no one to be exposed above 0.15, 0.10, and 0.05mg/m3 would have saved the population of 38,666 workers a total of 4336, 6587, and 8128 years of life, respectively. The greatest impact was observed for a cutoff of 0—i.e., for the most extreme intervention, in which nobody is ever exposed: in that case, a total of 22,652 years of life would have been saved. Conclusion: This method allows for a comparison of the impacts of hypothetical interventions limiting workplace exposures to below various levels. Interventions had greater impacts for lower OELs; there was no evidence of a threshold.

Abstract Number	**O-3-39-05**
Presenter	Kyle Steenland*, Conny Karnes, Vaughn Barry, Lyndsey Darrow
Exposure	others
Health domains	other
Type of research	cohort study

Attenuation of exposure effects over time: a simulation study

Abstract Background: Positive exposure-response trends often diminish at higher cumulative exposure, correlated with longer follow-up time. Depletion of susceptibles, increased measurement error at higher cumulative exposure, and saturation of biological pathways, have all been postulated as reasons for attenuation. Methods: We conducted simulations to evaluate rate ratios over time under different assumptions about susceptibility to exposure effects and measurement error; we evaluated exposure-response trends to determine whether attenuation was evident. We simulated a dynamic cohort in which entry occurred over time; the metric of interest was duration of exposure. We also considered cross-sectional analyses in which follow-up started only after a certain point of time. Simulations considered 10,000 subjects enrolled from 1940-2010 and followed through 2020. Ten simulations were conducted for each scenario and exposure-response parameters averaged. An excess relative risk model was used to generate the relationship between duration of exposure and disease, controlling for age. Measurement error of both classical and Berkson type were simulated, with increasing error with increasing exposure. Cox regression was used to evaluate exposure-response trends. Results: Under all scenarios considered with less than 100% susceptibility among the exposed, there was evidence of depletion of susceptibles over follow-up time. However, under realistic scenarios considered here, there was only modest evidence of attenuation of a linear exposure-response trend due to depletion of susceptibles. Classical measurement error, but not Berkson error, produced more marked attenuation. Cross-sectional analyses did not dramatically change attenuation patterns. Conclusions: Marked attenuation of exposure-response trends over follow-up time is more likely due saturation of biological pathways or, perhaps less likely, to classical measurement error - than to either the depletion of susceptibles or Berkson measurement error.

Abstract Number	**O-3-40-01**
Presenter	Cui Ling*, Michael Yost, Harvey Checkoway, Sverre Vedal, Noah Seixas, Shichuan Tang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Occupational Exposure Assessment for Engineered CaCO3 Nanoparticles

Background: Engineered nanoparticles (ENPs) are intentionally produced materials with specific properties. Emerging toxicological studies have demonstrated that exposure to ENPs could induce pulmonary diseases in animals. Little is known about the potential health effects in humans due to a lack of sufficient exposure information. To improve understanding of occupational exposure of ENPs, an exposure assessment was conducted in a CaCO3 nanoparticle manufacturing facility. Aims: The objectives of this research include characterizing job-based exposure and promoting understanding of metric suitable for nanoparticle exposure and epidemiological research. Methods: Personal and area air sampling was performed to estimate exposure of respirable dust. On-line instruments were used to measure the number concentrations and lung deposited surface area concentrations for manufacturing processes. Particle size, shape, element and degree of coagulation were assessed by SEM analysis. Results: Geometric mean of respirable mass concentrations ranged from 7.24 to 3195.86 µg/m^3 for area sampling and 44.69 to 6023.21µg/m^3 for personal sampling. Nanoparticles dominate in the workplace, which consists of 90-98% of respirable number concentration. There are three levels of emission sources. The highest exposure of nanoparticles occurs at modification process, identified to be single emission origin. The number concentrations in nanosized range vary with the distance to this source. The second form of nanoparticle release is related to specific process, which is intermittent and sparse. In addition, combustion and welding could produce nanoparticles as well. Respirable mass is not correlated with number concentration in respirable range (r =0.0090). The number concentration in nanoscale is modestly correlated with surface area deposited in alveolar (r=0.46) and TB (r=0.66) region. Conclusions: A complete exposure characterization of nanoparticles needs to be conducted in both bulk- and nano-form. (The abstract is subject to change with added epidemiological findings.)

Abstract Number	**O-3-40-02**
Presenter	Afshan Naseem*, Audil Rashid, Ikhtiar Uddin, Faiza Naseem
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	occupational study

Relationship between dermal exposure and PAH-DNA adducts in lymphocyte DNA in truck-drivers exposed to polycyclic aromatic hydrocarbons

Background: Truck drivers in Pakistan are confronted with numerous respiratory problems mainly because no proper occupational safety guidelines exist and health monitoring services are rarely extended to them. Aim: We aimed to assess dermal contamination by Polycyclic Aromatic Hydrocarbons (PAHs) among 79 truck drivers who work for more than six hours per day. Methods: We took both skin pad and urine samples to measure dermal exposure by PAH and subsequent secretion through body. Pyrene was used as biological marker for dermal exposure. Results: The results show that truck drivers have high PAH dermal exposure. However, the mean pyrene exposure levels were reduced to 33% when painters wore masks during work. The biological measure for the internal exposure to PAHs was urinary 1-hydroxyprene whose concentration was relatively low (range 21 and 133 nmol) when compared to dermal exposure levels. PAH-DNA adducts were observed in lymphocytes DNA among one-third of the workers. Using multiple regression analysis, we identified mass balance between dermal pyrene dose and 1-hydroxyprene excretion that confirmed the relevance of the dermal exposure route. Our estimates of the dermal and urinary pyrene levels clearly indicate that an average of 52% of the total absorbed amount of pyrene enters the body through the skin. Conclusions: Study concludes that mitigation measures to reduce PAH exposure should be focused more on the reduction of dermal contamination by PAHs than any other route. Moreover, use of occupational safety guideline must be prepared and distributed among truck drivers.

Abstract Number	**O-3-40-03**
Presenter	Vanessa Palmer, Jaime E. Hart, Eric Garshick, Thomas J. Smith, Francine Laden*
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Trace metal exposure and inflammatory biomarkers in a cohort of U.S. trucking industry workers

Background: Exposure to ambient particulate matter (PM) has been shown to be associated with biomarkers of inflammation in some studies. However, PM is a complex mixture of various compounds and little information is available on component specific effects. Aims: Using data from a cross-sectional pilot study in the US trucking industry, we evaluated the associations between ambient concentrations of trace metals and levels of biomarkers of systemic inflammation (interleukin 6(IL-6), C-reactive protein (hsCRP) and soluble intercellular adhesion molecule-1 (sICAM-1)). Methods: Blood samples for assessment of biomarkers were collected from 146 male trucking industry workers during the work day at trucking terminals in Carlisle, PA and Chicago, IL USA. Concurrent area-level measurements of PM2.5 were collected using 37 mm Teflon filters located in each work location. Concentrations for 51 metals were determined using X-ray fluorescence. Participants' personal exposures were assigned based on job title for the 12 hour period within which they provided blood. An individual constituent was eligible for analysis if it was present above the minimum detection limit on at least 50% of the filters. To control for PM2.5, residuals of each constituent regressed on PM2.5 were considered in separate linear regression models for each biomarker. Due to heterogeneity between the two populations and exposures, each terminal location was analyzed separately. Results: Nineteen metals met the criteria for analysis. The patterns of correlation among the constituents were different between the two terminals. We found statistically significant positive associations for chlorine and manganese with IL-6, copper with hsCRP and IL-6, and silver with sICAM1, but only at the Carlisle terminal. Conclusions: Our results indicate different mixtures of sources at the two trucking terminals measured. Only suggestive associations between some metals and some biomarkers of inflammation were observed and these were not consistent or necessarily expected a priori.

Abstract Number	**O-3-40-04**
Presenter	Andreas M. Neophytou*, Jaime E. Hart, Ellen A. Eisen, Eric Garshick, Francine Laden
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

A Structural Approach to Analyzing Occupational Cohorts: The Healthy-Worker Survivor Effect and an Application in the Trucking Industry Cohort

Background: Occupational cohort studies are often challenged by the presence of the Healthy Worker Survivor Effect (HWSE). While standard methods of analysis may be biased in the presence of HWSE, g-estimation of structural failure time models has been proposed as an alternative for reducing bias due to time-varying confounding by a variable affected by prior exposure. Aim: We assess the effect of years worked in specific jobs in the trucking industry on mortality, using a Structural Cumulative Failure Time Model (SNCFTM), to adjust for time-varying confounding. We also apply a Structural Accelerated Failure Time Model (SNAFTM) and compare both g-estimation results to results from standard Cox proportional hazards models. Methods: We used g-estimation of a SNCFTM to assess the effect of major job titles in the trucking industry on total and ischemic heart disease (IHD) mortality, in 30, 758 males employed in the unionized U.S trucking industry in 1985. Exposure was defined based on detailed work records. We also applied g-estimation of a SNAFTM and standard Cox proportional hazards models. The time-varying health surrogate was time taken off work. Results: The Risk Ratio obtained from the SNCFTM for total mortality comparing the risk had everyone been exposed as a Long-Haul Driver for the duration of follow up to the risk had nobody been exposed was 1.42 (95% CI: 1.16 – 1.77), and the RR for IHD mortality was 1.39 (95%: 1.01 – 2.09). SNAFTM and SNCFTM Hazard Ratio (HR) approximations were similar, but HRs from Cox proportional hazards models were lower. Conclusions: Effect estimates from the SNCFTM and SNAFTM indicate a higher all cause and IHD mortality risk for Long-Haul Drivers than Cox models. Thisdifference may partially reflect better control for the HWSE by the structural models. Structural failure time models may be useful in the analysis of occupational survival data and provide additional advantages compared to standard methods.

Abstract Number	**O-3-40-05**
Presenter	Vidhya Venugopal*, Madhan Chandran, Krishnan Srinivasan, Archana Prabukumar, Jeremiah Chinnadurai, Padmavathi Ramaswamy, Tord Kjellstrom
Exposure	climate change (temperature)
Health domains	healthrelated quality of life
Type of research	occupational study

Occupational heat exposures on working people: A systematic review

Introduction: Climate change and the potential impacts of raising temperatures on occupational health is rapidly gaining attention globally. Heat stress, a direct implication of climate change, significantly impacts working population, especially the poor in the developing countries. A need to conduct a systemic review of the existing research literature on occupational heat stress and its multidimensional impacts is imperative to understand the magnanimity of the problem, identify research needs & control interventions and exhibit research evidence for policy changes. Methods: A literature search for empirical studies regarding the impact of ambient temperatures on workers in high heat occupations was conducted using key words, databases including PubMed, ScienceDirect, Web of Science and reference lists of relevant research articles till Dec 2012. Inclusion was agreed based on the relevance by review of abstracts or full text. Results: The 600 related research articles, technical reports and book chapters were reviewed systemically in a framework and were grouped into the following categories: Climate change links, heat stress/strain, productivity loss, impacts and interventions. Quantitative data on WBGT afternoon values for 32 years shows an increase of 12.9 days/decade as is the number of hot days and for several months the WBGT goes above 30 C in Chennai, India. The results of the study clearly inform the magnitude and significance of heat stress and its future impacts on workers' health. Though interventions were addressed in many studies, feasible low-cost interventions were observed only in few studies. Conclusions: The review clearly points the research needs to profile the most vulnerable working population and estimate various future impacts due to rising temperatures. Globally used feasible, low-cost interventions must be considered to bring about healthy sustenance of the working population. The review reemphasizes the need for designing stronger policies to protect the working population from risks of heat stress.

Abstract Number	**O-3-41-01**
Presenter	Maria Tellez Plaza*, Eliseo Guallar, Richard R. Fabsitz, Barbara V. Howard, Jason G. Umans, Kevin A. Francesconi, Walter Goessler, Richard B. Devereux, Ana Navas-Acien
Exposure	metals
Health domains	cardiovascular disease
Type of research	cohort study

Cadmium Exposure and Incident Peripheral Arterial Disease

Aims: Cadmium has been associated with peripheral arterial disease in cross-sectional studies but prospective evidence is lacking. Our goal was to evaluate the association of urine cadmium with incident peripheral arterial disease in a large population-based cohort. Methods: A prospective cohort study was performed with 2,864 adult American Indians 45-74 years old from Arizona, Oklahoma and North and South Dakota who participated in the Strong Heart Study in 1989-91 and were followed through two follow-up examination visits in 1993-1995 and 1997-1999. Participants were free of peripheral arterial disease, defined as an ankle brachial index <0.9 or >1.4, at baseline and had complete baseline information on urine cadmium, potential confounders and ankle brachial index determinations in the follow-up examinations. Urine cadmium was measured using inductively coupled plasma mass spectrometry (ICPMS) and corrected for urinary dilution by normalization to urine creatinine. Multivariable-adjusted hazard ratios were computed using Cox-proportional hazards models for interval-censored data. Results A total of 470 cases of incident peripheral arterial disease were identified. After adjustment for cardiovascular disease risk factors including smoking status and pack-years, the hazard ratio comparing the 80th to the 20th percentile of urine cadmium was 1.41 (1.05, 1.81). The hazard ratio comparing the highest to the lowest tertile was 1.96 (1.32, 2.81). The associations persisted after excluding participants with ankle brachial index > 1.4 only as well as in subgroups defined by sex and smoking status. Conclusions: Urine cadmium, a biomarker of long-term cadmium exposure, was independently associated with incident peripheral arterial disease, providing further support for cadmium as a cardiovascular disease risk factor.

Abstract Number	**O-3-41-02**
Presenter	Lars Barregård*, Björn Fagerberg, Goran Bergstrom
Exposure	metals
Health domains	cardiovascular disease
Type of research	cohort study

Cadmium exposure and peripheral artery disease. A cohort study.

Background: Cadmium exposure has been found to be associated with atherosclerotic plaques in the carotid arteries. Aims: To examine if blood and urinary cadmium levels are associated with low ankle-brachial index as a measure of peripheral artery disease in a longitudinal study. Method: This is a prospective cohort study with a 5-year follow-up of 64-year old women (n=489) recruited by stratified sampling of similarly-sized groups with normal, impaired and diabetic glucose tolerance as assessed in a population-based screening examination. The primary outcome measure was ankle-brachial index (ABI - ratio of the systolic blood pressures in the tibial and brachial arteries ≤0.9 in any artery). Exposure to cadmium was based on cadmium in blood (B-Cd) and urine (U-Cd) at baseline. Cadmium levels were determined by ICP-MS with relevant analytical quality control. Odds ratios (OR) were calculated using logistic regression models including cardiovascular risk factors at baseline (pack years of smoking, systolic blood pressure, HbA1c, and apolipoprotein B/A-I as measure of dyslipidemia) as well as statin treatment and serum ICAM-I. Results: High concentrations (tertile 3 vs. tertile 1) of blood (B-Cd) or creatinine-adjusted urinary cadmium (U-Cd) at baseline were found to predict low ankle-brachial index after adjustment for smoking and other cardiovascular risk factors at baseline. For U-Cd the OR was 2.5 (95% CI 1.1-5.8). After exclusion of participants with ultrasound-assessed femoral atherosclerosis at baseline the OR for U-Cd was unchanged, and for B-Cd it was 3.7 (95% CI 1.05-13.3). Inclusion of serum ICAM-1 levels did not affect the cadmium-related ORs in multivariate analyses. Conclusions: Cadmium exposure was associated with future peripheral artery disease, supporting the concept that cadmium exposure in the population has pro-atherogenic effects, although ICAM-1 mediated effects do not seem to be involved.

Abstract Number	**O-3-41-03**
Presenter	Bruce Lanphear*, Stephen Rauch, Richard Hornung, Ryan W. Allen
Exposure	metals
Health domains	cardiovascular disease
Type of research	cohort study

Blood Lead Concentrations and Cardiovascular Mortality in the United States: The NHANES Mortality Follow-up Cohort Study

Background: Environmental lead exposure, measured using blood lead concentration, is an established risk factor for hypertension, but the relation of blood lead concentration with cardiovascular disease (CVD) mortality and the number of deaths attributable to it are uncertain. Aims: To quantify the contributions of lead exposure to all-cause mortality and CVD mortality in the United States. Methods: We quantified the contribution of blood lead concentration to total deaths and deaths from CVD, ischemic heart disease (IHD) and acute myocardial infarction (AMI) among 11,261 adults (>30 years at baseline) in the NHANES Follow-up Study. Participants were followed through December 31, 2006. We used Cox proportional hazard regression and adjusted for a variety of confounders, including sex, age, race, current and former tobacco use, income, obesity, diet, cholesterol, urinary cadmium, diabetes, hypertension, and physical activity. Results: During a median follow-up of 14.5 years, 3,290 participants died; 1,430 (43%) from CVD. The geometric mean blood lead of participants at baseline was 2.95 mg/dL; 3,065 (21.7%) had a blood lead >5 mg/dL. Adjusted hazard ratios for death among participants with blood lead levels in the highest tertile (> 3.9 mg/dL) compared with the lowest tertile (< 1.9 mg/dL) were 1.28 (95%CI=1.10, 1.49) for total mortality, 1.56 (95%CI=1.20, 2.01) for CVD mortality, 1.71 (95%CI=1.19, 2.45) for IHD mortality and 1.97 (95%CI=1.15, 3.36) for AMI mortality. Adjusted population attributable fractions were 11.2% (95% CI=0.13, 21) for total mortality, 19.2% (95%CI=4.4 to 32) for CVD mortality, 23.3% for IHD mortality (95%CI=5.3 to 38), and 27.1% (95%CI=5.7 to 43.6) for AMI mortality. We estimate that lead exposure accounts for 247,000 avoidable deaths each year; 175,000 from CVD, 122,000 from IHD deaths and 55,000 from AMI. Conclusion: Low-level, environmental lead exposure is a leading, but largely ignored risk factor for cardiovascular mortality in the United States.

Abstract Number	**O-3-41-04**
Presenter	Kelly Bakulski*, Jennifer Weuve, Zishaan Farooqui, Patricia A. Cassano, David Sparrow, Marc G Weisskopf, Katherine L. Tucker, Howard Hu, Sung Kyun Park
Exposure	metals
Health domains	other
Type of research	cohort study

MTHFR genotype modifies the effect of lead exposure on plasma homocysteine in older adults

Background: Lead exposure appears to elevate homocysteine, a one-carbon metabolite and important risk factor for chronic cardiovascular and neurodegenerative diseases. The influence of genetic susceptibility on lead exposure's association with homocysteine is unknown. Aims: To determine the joint relation of lead exposure and polymorphisms in the methylenetetrahydrofolate reductase (MTHFR) gene, which encodes a key enzyme in one-carbon metabolism, to plasma homocysteine. Methods: From a subcohort of the VA Normative Aging Study (n=876 older men), we obtained data on genotypes of MTHFR, cumulative lead exposure, and repeated measures of recent lead exposure and plasma homocysteine. We used multivariable-adjusted linear regression and linear mixed effects models to assess the interaction of lead exposure and genotype on homocysteine. Results: The association of blood lead concentration with plasma homocysteine varied significantly by MTHFR genotype at five of eleven loci (rs4846049, rs6541003, rs1994798, rs1801133, and rs1801131; P<0.05). For example, among men with the major allele (AA) at rs1801131, an interquartile range (IQR) difference in blood lead concentration (3 ug/dl) was associated with 6.6% higher plasma homocysteine (95% CI: 4.5% to 8.8%), while among men with the minor allele (CC) (resulting in a non-synonymous amino acid change), blood lead level was not associated with homocysteine (an IQR difference in blood lead associated with -1.4% difference in homocysteine, 95% CI: -6.1% to 3.5%). At visit one, participants with two copies of the most frequent (33.6%) MTHFR haplotype had the strongest lead-homocysteine association; an IQR increase in blood lead was associated with a 13.0% increase in homocysteine (95% CI: 6.0-19.9), compared to men with one (9.9%) or zero (4.9%) copies of this haplotype. Conclusions: The MTHFR gene may influence susceptibility to lead-induced elevation in homocysteine. A one-carbon metabolism pathway analysis of lead and homocysteine will also be explored.

Abstract Number	**O-3-41-05**
Presenter	Junenette Peters*, M. Patricia Fabian, Jonathan Levy
Exposure	metals
Health domains	cardiovascular disease
Type of research	others

Multiple chemical and non-chemical exposures related to blood pressure within the National Health and Nutrition Examination Survey

Background: There is increasing interest in methods that consider the joint influence of multiple stressors on health outcomes leveraging epidemiological data. Blood pressure is a candidate outcome which has been related to both chemical and non-chemical factors. Aim: We explore structural equation modeling as an approach to create predictive models of exposures and integrate them in relationship to blood pressure. Methods: This study uses data from the National Health and Nutrition Examination Survey (NHANES) 1999-2008 to develop exposure models applicable to a cumulative risk assessment application in a low-income community near a hazardous waste site. We focused on four chemicals previously associated with blood pressure - lead, cadmium, mercury and polychlorinated biphenyls (PCB). As predictors of chemical exposures, we examined demographics (e.g. age, sex, race/ethnicity, country of birth, education); dietary information (fish and shellfish consumed); and other characteristics (e.g., smoking, healthcare, geography). Predictors for each chemical were included based on statistical significance (p-value ≤ 0.05) or whether inclusion changed the predictive value by ≥ 10%. Models were then simultaneously related to measures of blood pressure using structural equation modeling, to help separate the influence of predictors from chemical exposures. Results: Common predictors of chemical exposures included race/ethnicity, smoking and geography. Other predictors varied by contaminant. In structural equation models, lead was generally the larger pollutant contributor to blood pressure and was positively related to systolic blood pressure, diastolic blood pressure and mean arterial pressure. The associations with cadmium, mercury and PCB differed by blood pressure measure. Conclusion: This research demonstrates the ability to jointly consider chemical and non-chemical exposures and their impact on cardiovascular health in the context of cumulative risk assessment.

Abstract Number	**O-3-42-01**
Presenter	Sofia Temam*, Nino Kuenzli, Josep Maria Anto, Jean Bousquet, Debbie Jarvis, Nicole Le Moual, Nicole Probst-Hensch, Jordi Sunyer, Bénédicte Jacquemin
Exposure	ambient air pollution
Health domains	equity
Type of research	cross-sectional study

ASSOCIATION BETWEEN SOCIOECONOMIC STATUS (SES) AND AIR POLLUTION EXPOSURE IN EUROPE

Background and aims: Association between lower SES and poorer health is well known. Environmental exposures could contribute to health inequalities. Our aim is to assess the association between air pollution and SES in European urban areas. Methods: Within the context of ECRHS (European Community Respiratory Health Survey), we assessed the association between SES based on education and on occupation (social class) and the level of NO2. For both indicators, we compared the subjects in the highest tertile with the ones in the other two. NO2 was estimated at the home address with a Land Use Regression model (ESCAPE: European Study of Cohorts for Air Pollution Effects). Results: 3592 subjects, from 14 centres in 7 countries of Western Europe, having NO2 estimations and who answered to the second follow-up questionnaire of ECRHS were included. The median concentration of NO2 was 26.2 µg/m3 (IQR 18.4-37.0). We found heterogeneity between centres with medians going from 4.3 µg/m3 in Umea (Sweden) to 56.2 µg/m3 in Turin (Italy) but also within centres (i.e. min:22.3 max:115.5 in Barcelona (Spain)). In the pooled analyses, NO2 concentrations adjusted for age and sex were significantly higher in the highest social class (28.8 µg/m3 vs 27.2 in the lowest classes) and in those with higher education (29.6 µg/m3 vs 28.1 in those with lower education). After adjusting for centre, the difference was no longer significant. The p-value for heterogeneity between centres was <0.001. In Umea we found that subjects with higher education or social class were more exposed while it was the inverse in Erfurt for education and in Huelva for social class. Conclusion: We observed that subjects having a higher social class or educational level were more exposed to NO2 but with heterogeneity between centres. It will be interesting to assess these associations with more precise social indicators and to look for geographical patterns. Acknowledgements: ANSES EST-12-166, ESCAPE EC-FP7-GA 211 250, ECRHS

Abstract Number	**O-3-42-02**
Presenter	Daniela Fecht*, Paul Fischer, Lea Fortunato, Gerard Hoek, Kees de Hoogh, Marten Marra, Hanneke Kruize, Danielle Vienneau, Rob Beelen, Anna Hansell
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cross-sectional study

Associations between air pollution and socioeconomic characteristics, ethnicity and age profile of neighbourhoods in England and the Netherlands

Background. Air pollution levels are generally higher in socially deprived areas but the demographics to explain this environmental inequality at a local level are, still not fully understood. This is essential, however, to understand the public health implications. Aim. We analysed associations between population characteristics and long-term exposure to ambient particulate matter with aerodynamic diameter ≤ 10 µm (PM10) and nitrogen dioxide (NO2) in two European countries. We further investigated whether these associations differed between national, regional and city level. Methods. We compared publicly available population characteristics (socio-economic characteristics, ethnicity, age) with detailed maps of PM10 and NO2 concentrations modelled using land use regression at the neighbourhood level in England and the Netherlands. Results. For England the most deprived neighbourhoods experienced 4.4 µg/m3 higher levels of NO2 pollution compared to the least deprived, but there was less difference with PM10. In the Netherlands, air pollution levels were not associated with deprivation. In England, marked differences also existed with ethnically diverse neighbourhoods (increase in NO2 of 10.1 µg/m3 compared to white neighbourhoods) and higher inequalities in air pollution levels were found in urban areas with both deprivation and ethnic composition of neighbourhoods. For both countries, associations for some areas were different from from the national results. Conclusion. Environmental inequity may differ between different cities, regions and countries. Environmental inequity related to NO2, a marker for traffic related pollution, is strongest in urban areas, which suggests that policies to reduce inequality in air pollution exposures should consequently focus on transport related measures.

Abstract Number	**O-3-42-03**
Presenter	Cindy Padilla*, Veronica Vieira, Benoît Lalloué, Wahida Kihal, Denis Zmirou-Navier, Séverine Deguen
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	health impact assessment

NEONATAL MORTALITY, OUTDOOR AIR POLLUTION AND SOCIAL INEQUALITIES– A SPATIAL ANALYSIS CONDUCTED AT A SMALL GEOGRAPHICAL LEVEL IN THREE FRENCH METROPOLITAN AREAS

Background. Progress towards reducing neonatal deaths (before 28 days of life), has been slow and early deaths now account for a high proportion of infant deaths. Mapping spatial distributions of disease occurrence can serve as a useful tool for identifying exposures of public health concern. Aims. To investigate the influence of socioeconomic characteristics and outdoor air pollution on the spatial distribution of neonatal mortality. Methods. We conducted an ecological study using the French census block as the geographical unit, in the metropolitan areas of Lille (North of France), Lyon (center) and Paris. The outcome variable was neonatal mortality; all cases that occurred between2002 and 2009, except for Paris 2004-2009, were geocoded using address of residence. A neighborhood deprivation index was created, using data from the 2006 census. Average nitrogen dioxide concentrations were modeled by the air quality monitoring networks. Generalized additive models allowed to take into account spatial autocorrelation and generate maps using smoothing on longitude and latitude while adjusting for covariates. We used permutation tests to examine the overall importance of location in the model and identify areas of increased risk. Results. The strength and direction of the associations varied between cities. We found areas of elevated risk within the Lille (365 cases: 2.97‰ of live births) and Lyon (410; 2.78‰) metropolitan areas but not in Paris (462; 2.46‰). While in Lyon, the socioeconomic status has an important impact, in Lille, both deprivation and NO2 estimates have their own role as determinants of the spatial distribution of neonatal mortality. Conclusions. There is evidence of a variety of spatial patterns of neonatal mortality in French metropolitan areas in relation with socioeconomic deprivation and ambient air quality. This illustrates the relevance of spatial statistical techniques to model exposure and identifies priority areas for public health action.

Abstract Number	**O-3-42-04**
Presenter	Lara Clark*, Dylan B. Millet, Matthew J. Bechle, Julian D. Marshall
Exposure	ambient air pollution
Health domains	equity
Type of research	cross-sectional study

Environmental injustice and inequality: NO2 air pollution in the United States

Background: Communities with lower socioeconomic status often have higher exposure to air pollution and higher susceptibility to air pollution health impacts. Aim: To describe and compare environmental injustice and inequality in residential outdoor air pollution for the entire contiguous United States population, including both urban and rural areas. Methods: We employ a recent national land-use regression for Census block –level nitrogen dioxide (NO2) and Census socioeconomic data (~1-km2 urban spatial resolution). Our analyses compare population-weighted NO2 concentrations by socioeconomic characteristics (race-ethnicity, income, poverty status, education level) and calculate environmental injustice and inequality statistics for US regions, states, counties and urban areas. Results: Nationally, population-weighted mean NO2 concentrations are 3.4 ppb (27%) higher for low-income nonwhites than high-income whites. Inequality for NO2 concentration is greater than inequality for income (Atkinson Index: 0.11 [NO2] versus 0.08 [income]). NO2 disparities are similar in magnitude by income and by race. For example, within individual urban areas, NO2 concentrations are, on average, ~8% higher for nonwhites than whites (after controlling for income) and ~5% higher for low-income than for high-income groups (after controlling for race). Ambient NO2 concentrations are higher than average for low-income nonwhite young and old people. Conclusions: Previous work has documented air pollution environmental injustice and inequality within individual US metropolitan areas and regions; our research establishes a national context for trends throughout the continental US.

Abstract Number	**O-3-42-05**
Presenter	Julian D. Marshall*, Katie Swor, Nam Nguyen
Exposure	ambient air pollution
Health domains	equity
Type of research	exposure modeling

Measuring and improving environmental equality and justice: Diesel particles in California's South Coast

Background and Aims Environmental policies aim to reduce emissions, but there are not standards for addressing environmental justice. Research documents disparities in exposure to air pollution, but gives little guidance on how to improve disparities or how specific emission-reduction scenarios would affect environmental justice. Methods We model the expected air pollution and exposure benefits from reducing emission of diesel-generated particulate matter (DPM) in Southern California. We compare five sources of DPM: on-road mobile (e.g., trucks), off-road mobile (e.g., construction equipment), ships, trains, and stationary sources (e.g., generators). We quantify how emission reductions from each source would change environmental equality (metric: Atkinson Index) and justice (the relative exposure difference between high- and low-socioeconomic [SES] individuals). Results and Conclusions On- and off-road mobile sources together constitute a majority of total emissions in the South Coast. Train sources, which are only a minor contributor to overall emissions, offer strong opportunities for efficient and equitable improvements in air pollution. The improvement to exposure equality per emission reduction is two times higher for trains than for on-road sources. Surprisingly, reducing ship emissions would worsen environmental justice. The reason is that while exposures are higher for low-SES than for high-SES for all sources (including ships), there is less of a disparity for ship emissions than for the overall average for DPM; therefore, reducing only ship emissions would widen existing disparities in exposures. Our approach could be readily applied in other urban areas to quantify and prioritize among opportunities to improve environmental equality and justice.

Abstract Number	**O-4-05-01**
Presenter	Jill Baumgartner*, Ming Shan, Majid Ezzati, Emma Coady, Xudong Yang
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Characterizing household air pollution exposures and cardiovascular risk in rural Chinese women

China has a large and growing cardiovascular disease burden. Household air pollution (HAP) has been associated with higher blood pressure and is thought to increase risk of cardiovascular outcomes, though the empirical evidence is limited and mechanisms are unclear. We assessed personal HAP exposure, markers of arterial stiffness and function, and biological markers of oxidative stress in Chinese women cooking and heating with solid fuels. We enrolled 42 rural Chinese women (mean age=55±12) and measured their blood pressure and 24-hr exposure to PM2.5 and black carbon (BC) using personal gravimetric systems. In a subsample of women (n=25), we measured telomere length from buccal swabs, a biomarker linked to oxidative stress, and assessed pulse wave velocity (PWV) and augmentation index (AI) using a noninvasive device. To our knowledge, this is the first study to measure these important vascular endpoints in a rural, developing country setting. Women's 24-hr BC exposure ranged from 1-129 µg/m3 (mean: 21) and PM2.5 exposure ranged from 20-1365 µg/m3 (mean: 207), far exceeding the WHO PM2.5 guideline (25 µg/m3). Age-adjusted pollution exposure was associated with shorter telomere length (PM2.5: -0.4 per 10 µg/m3 (95% CI:-0.9, 0.1); BC: -0.8 per 10-µg/m3 (95% CI:-3.0, 1.1). Higher PM2.5 exposure was associated with higher systolic blood pressure (3.0 mmHg, 95% CI:-3.4, 9.5), after adjusting for age, income, waist circumference and other covariates. Mean PWV (7.9±1.1 m/s) and AI (23.8±4.9%) values in our study subset increased with both higher blood pressure and age, but were lower than those observed in urban Chinese women. In multivariate models, a log-increase in PM2.5 exposure was associated with higher AI (2.2%; 95% CI:-1.4, 6.0), but lower PWV (-0.5 m/s; 95% CI:-1.2, 0.3). While these data are from a small initial assessment, they offer the possibility that changes in vascular function and stiffness from HAP exposure may impact cardiovascular risk, with oxidative stress potentially mediating this relationship.

Abstract Number	**O-4-05-02**
Presenter	Maggie L. Clark*, Annette M. Bachand, Judy M. Heiderscheidt, Bevin Luna, Stephen J. Reynolds, Kirsten A. Koehler, John Volckens, David Diaz-Sanchez, Jacqueline D. Carter, Lucas M. Neas, Jennifer L. Peel
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Household air pollution from biomass combustion and measures of systemic inflammation among Nicaraguan women

Background:Approximately three billion people use inefficient indoor cookstoves for cooking and heating needs, which can result in high household air pollution concentrations. Few studies have evaluated the relationship between indoor biomass burning and cardiovascular effects. Aims: (1) To evaluate the cross-sectional relationship between pollutant measures and markers of systemic inflammation and (2) to measure the impact of a cleaner-burning cookstove intervention on changes in systemic inflammation. Methods: We conducted a pilot-level cookstove intervention among 123 Nicaraguan households. At baseline, we measured 48-hour indoor fine particulate matter (PM 2.5), indoor carbon monoxide (CO), and personal CO concentrations. Female primary cooks provided finger-stick dried blood spot samples at baseline and one year following the cookstove intervention. We analyzed C-reactive protein (CRP; n=36 evaluated to date); further analyses will include SAA, s-ICAM1, s-VCAM1, IL-1B, IL-6, IL-8, and TNF-α. Results: Based on preliminary results at baseline, a 25% increase in personal CO was associated with a 6% increase in CRP (p=0.04). No associations were observed between indoor pollutant concentrations and CRP. Additionally, results from the intervention phase suggest that greater reductions in CRP from baseline to follow-up were observed among those with higher education (6+ years) and among those women who placed the intervention stove in the same spot that was previously occupied by the traditional stove (potentially an indicator that the traditional stoves were no longer used during follow-up or were moved outside of the kitchen for secondary use). Conclusions:Preliminary results suggest that elevated pollutant exposures are associated with increased systemic inflammation. Some subgroups of the population (potentially those maintaining and using the intervention stove more sustainably) may experience greater benefits from a cookstove intervention. This abstract does not necessarily reflect the policies of the U.S. Environmental Protection Agency.

Abstract Number	**O-4-05-03**
Presenter	Adwoa Commodore, Junfeng Zhang*, Yan Chang, Stella Hartinger Pena, Claudio Lanata, Daniel Mäusezahl, Daniel Hall, Manuel Aguilar-Villalobos, John Vena, Jia-Sheng Wang, Luke P Naeher
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Concentrations of Urinary 8-Hydroxy-2'-deoxyguanosine and 8-isoprostane in Women Exposed to Woodsmoke in a Cookstove Intervention Study in San Marcos, Peru

Background: Nearly half of the world's population is exposed to household air pollution (HAP) due to long hours spent in close proximity to unvented cooking fires. Aims: To investigate whether woodsmoke exposure induces oxidative stress by examining the relationship between woodsmoke exposure and biomarkers of DNA oxidation (8-hydroxy-2'-deoxyguanosine [8-OHdG]) and lipid peroxidation (8-isoprostane) among control and intervention stove users. Methods:We conducted HAP exposure assessment within the framework of a community-randomized controlled trial of 51 communities in San Marcos Province, Cajamarca Region, Peru.The first morning urine voids after 48hr HAP exposure assessment were taken from a subset of 45 control and 39 intervention stove users, for whom PM2.5 and/or CO data were available, were analyzed for 8-OHdG and 8-isoprostane. Control households used a number of stoves including open fire and chimney stoves while intervention households used study-promoted OPTIMA chimney stoves. General linear models and correlation analyses were performed. Results: Creatinine corrected urinary oxidative stress biomarkers ranged from 11.2 to 2270.0 µg/g creatinine (median: 132.6 µg/g creatinine) for 8-OHdG and from 0.1 to 4.5 µg/g creatinine (median: 0.8 µg/g creatinine) for 8-isoprostane among all study subjects (n=84).After controlling for the effects of traffic in the community and eating food exposed to fire among all subjects, cooking time was weakly, but positively associated with urinary 8-OHdG (r=0.29, p=0.01, n=80). Subjects' real-time personal CO exposures were negatively associated with 8-OHdG. 48hr time integrated personal PM2.5 was negatively, but marginally associated with urinary 8-isoprostane (r=-0.21, p=0.09, n=69) after controlling for the effect of distance of homes to the road. Conclusion: Results suggest that there is sustained systemic oxidative stress in terms of 8-OHdG among these Peruvian women chronically exposed to wood smoke.

Abstract Number	**O-4-05-04**
Presenter	Wayne Ott*, Lance Wallace
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Experimental Results for Fine and Ultrafine Particles Measured in Cooking Activities

Indoor air studies indicate cooking is a major source of exposure to particulate matter, but few quantitative studies have been done of the factors responsible for elevated cooking emissions and exposures. Our aims were to understand how different components of the cooking process affect exposures to both fine and ultrafine particles (FP and UFP). We conducted 35 controlled experiments cooking foods in a residential kitchen to determine how cooking procedures affected concentrations. We used a Model 3007 CPC (TSI) to measure particles from 10 nm to 1 µm in diameter. Since fresh emissions from cooking fuel alone (whether gas or electric) create very few particles > 100 nm, this instrument measures UFP primarily. However, particles <10 nm can be produced by stovetop cooking, so our results may be underestimates of total UFP in some cases. We also used a TSI laser photometer equipped with a PM2.5 impactor to measure FP. We found that both electric and gas grills emitted large quantities of UFP. A heated pan without food generated even larger quantities of UFP but virtually no PM2.5. A gas burner without a grill produced a modest peak UFP concentration averaging 6,500 particles/cm3, but adding a metal grill increased the peak UFP concentration to 43,000 particles/cm3, and adding an empty stainless steel pan to the grill increased the average peak UFP to 174,000 particles/cm3. An electric burner by itself caused a similar high UFP peak concentration of 72,000 particles/cm3 with no pan or food. In contrast, PM2.5 concentrations were zero unless food was being cooked. Cooking lean bacon on either the gas or electric grill resulted in both elevated UFP and elevated PM2.5 concentrations. These results were surprising. Even without food, both gas and electric grills emitted large quantities of UFP but no PM2.5, while cooking meat in a pan on both gas and electric grills caused both elevated UFP and elevated PM2.5. These results provide insight into new ways to reduce exposure to particulate matter generated by cooking activities.

Abstract Number	**O-4-05-05**
Presenter	Ian Longley*, Guy Coulson, Elizabeth Somervell, Emily Wilton
Exposure	ambient air pollution
Health domains	no health domain
Type of research	review

10 years of research on woodstove emissions and exposure in New Zealand – a review

Background It is likely that most New Zealanders are exposed to woodsmoke. Woodburning is the dominant source of PM10 in most of the country, and the principal cause of exceedences of the 24-hr standard (50 mg m-3). Recent earthquakes in Christchurch have both introduced a perturbation into the emissions profile of a major city and intensified scrutiny of the scientific evidence surrounding the costs and benefits of wood-burning as a source of sustainable home heating. Aims To review the past 10 years of research on woodburning, highlighting significant findings and remaining knowledge gaps. Methods Early research focussed primarily on derivation of emission factors from small numbers of representative woodburning stoves, including modern “low emission” models. In addition to conventional laboratory studies, an emphasis was placed onin-situmeasurements in occupied homes. More recent work has focussed on mapping emissions and concentrations (including the use of mobile monitoring platforms) and identifying the contribution of woodburning to indoor concentrations. Results Woodstove PM10 emission factors derived from 390 in situ tests (51 stoves) exhibit a log-normal distribution with a geometric mean of 9.8 and 3.9 g/kg (dry wood) for older and low-emission stoves respectively, but with substantially larger ranges than observed in laboratory tests. Variability is associated with factors representing combustion efficiency. Mobile monitoring has found divergences between emission inventories and observed concentrations. Indoor PM concentrations in some wood-burning homes appear to be substantially higher than ambient concentrations. Conclusions The ‘user’ appears to be a significant variable which introduces substantial variability in woodstove emissions and indoor exposure. Associating combustion efficiency with particular households or locations remains a challenge for air quality management and exposure assessment.

Abstract Number	**O-4-07-01**
Presenter	Elaine Hill*
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Resource Extraction and Infant Health: Evidence from Colorado

Background: The benefits and costs of resource extraction are currently being hotly debated in the case of shale gas development (commonly known as "fracking"). Colorado provides a unique research environment given its long history of conventional oil and gas extraction and, most recently, shale gas development. Aims: Building upon the first paper to find a relationship between shale gas development and infant health at birth in Pennsylvania (Hill 2012), this paper uses Colorado to explore health at birth implications of other shale plays and explores the risks associated with shale development compared with other forms of drilling. Methods: Using detailed vital statistics and mother's residential address to define exposure as close proximity to drilling activity. First, the inverse distance from the closest well provides a continuous treatment measure. Then using a difference-in-differences approach, this paper compares health at birth of infants born to residences within 1 km of the well head versus 2 km to identify the intensive margin of drilling. Results: When utilizing a treatment variable defined as the inverse distance from the closest well piror to birth, a negative and significant impact on proximity to any drilled well on infant health at birth measures (birth weight, gestation, low birth weight and premature birth) is found. Since inverse distance is not a linear function of proximity, interpretation cannot be made directly, but the direction of the results suggest detrimental impacts for infants born closer to a well prior to birth. When utilizing a difference-in-differences estimator, the results suggest that infants whose mother's residences are within 1 km of a drilled well prior to birth weigh less, have shorter gestation periods and are more likely to be both low birth weight and premature. Conclusions: Exposure to drilling within 1 km of the well head results in adverse infant health outcomes.

Abstract Number	**O-4-07-02**
Presenter	Rajen Nithiseelan Naidoo*, Anil Chuturgoon, Poovendhree Reddy, Kareshma Ramcharan, Sheena Muttoo, Frederick Feldman
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cross-sectional study

BIRTH OUTCOMES, BIOMARKERS OF OXIDATIVE STRESS AND EXPOSURES TO OXIDES OF NITROGEN: FINDINGS FROM A BIRTH COHORT PILOT

Background. Oxides of nitrogen (NOx) have been associated with adverse birth outcomes (ABO) and biochemical changes among pregnant females. These exposure-related biochemical changes have not been previously described in HIV prevalent population. Aims. To pilot the methodological approaches for a birth cohort, and to determine associations between ABO, biomarkers of oxidative stress and exposures to NOx. Methods. Pregnant women selected from public sector antenatal clinics in the polluted south Durban (n=50) and north Durban (n=50) were interviewed and tested for oxidative stress, allergy, atopy, genetic polymorphisms and HIV status. Neonatal genetic testing, was conducted. Maternal blood levels of vitamins associated with oxidative stress, (A and E) were assessed. Exposure to NOx was determined through land use regression models, using exposure data from a passive sampling monitoring. Results. NOx varied significantly between the south and north, with mean levels of 43.5 mg/m3 (range: 15.4–84.4 mg/m3) and 12.6 mg/m3 (7.7–21.7 mg/m3) respectively. Mean predicted exposures of the participants varied geographically: north participants:19.8 mg/m3 (range: 4.8-30.9 mg/m3); south participants: 39.8 mg/m3 (21.9-53.1 mg/m3). Mean age was similar among those with high exposure (25.4 years) and low exposure (25.2 years). The overall prevalence of ABO was 23.5%. High exposure resulted in an elevated risk (odds ratio=1.9, 95% CI: 0.6-5.7) for ABO, adjusted for ethnicity, education, income, HIV status and cigarette smoke (personal or passive). Of the various biochemical markers of oxidative stress, only GSH was associated with exposure (increasing exposure resulting in declining GSH levels). The other biomarker which differed significantly with exposure groupings was comet tail length. Of the nutrition markers, only vitamin E levels varied by exposure group, and none were associated with ABO. Conclusions. This pilot successfully tested methodological challenges for a birth cohort. Preliminary data analysis suggests environmental exposure related risks for ABO.

Abstract Number	**O-4-07-03**
Presenter	David Savitz*, Jennifer Bobb, Jane Clougherty, Francesca Dominici, Beth Elston, Kazuhiko Ito, Zev Ross, Thomas Matte
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Ambient Fine Particulate Matter, Nitrogen Dioxide, and Term Birth Weight in New York City

Background The growing volume of studies addressing the association between air pollution and pregnancy outcomes remains inconclusive due to methodologic limitations. Using a unique community air pollution survey in New York City, we addressed this question with improved exposure assessment, a large number of births, freedom from confounding by socioeconomic status, and refined analytic methods. Aims We assessed the relationship between exposure to ambient pollutants, fine particulate matter (PM2.5) and nitrogen dioxide (NO2), and a term birth weight, considering trimester-specific and aggregate pregnancy exposure. Methods We included 252,967 singleton, term births to non-smokers, without congenital malformations, with known address, with birth dates in the years 2008-2010 restricted to avoid fixed cohort bias. Data from the New York City Community Air Survey were used to estimate exposure for all two week periods at all residences based on a network of 150 monitors. We examined term birth weight (37-42 weeks' gestation), adjusting for maternal age, ethnicity, education, parity, insurance status, neighborhood socioeconomic indices, week of gestation, and calendar year using linear mixed models. Results An interquartile shift in PM2.5 in the three trimesters and over the entire pregnancy was associated with predicted birthweight decrements of 6.1, 3.3, 8.5, and 11.9 grams, respectively. For NO2, an interquartile shift in exposure for the three trimesters and total pregnancy predicted greater birthweight decrements of 11.3, 12.6, 13.6, and 11.2 grams, respectively. Conclusions Intra-urban and temporal sources of variation in PM2.5 and NO2 show a clear statistical association with a reduction in birth weight, adding to evidence from other studies that exposure to combustion pollutants may adversely affect fetal growth. The estimated effect, while modest at the individual level, would have important implications for population health if causal.

Abstract Number	**O-4-07-04**
Presenter	David Q Rich*, Jinliang Zhang, Sally Thurston, Timothy Stevens, Pan Ying, Kaibo Lu, Pamela Ohman-Strickland, Barry Weinberger, Tracey Woodruff, Xiaoli Duan, Junfeng Zhang
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	others

Increases in Birth Weight Associated With the 2008 Beijing Olympic Air Pollution Reduction: Results from a Natural Experiment

Background: Previous studies have reported decreased birth weight associated with increased ambient air pollutant concentrations during pregnancy. However, it is not clear in which trimester or month air pollution exposure has the strongest effects on birth weight. Aims: Using the natural experiment of the drastic, but temporary, air pollution declines during the 2008 Beijing Olympics, we evaluated whether having specific months of pregnancy (i.e. 1st, 2nd…8th) during the 2008 Olympic period resulted in larger birth weights, compared to the same dates in 2007 or 2009. Methods: Using n=18,835 term births (37-42 weeks gestation) to mothers residing in 4 urban districts of Beijing (Xicheng, Chaoyang, Fengtai, Haidan), we estimated the change in birth weight associated with having individual months of pregnancy (months 1-8) during the 2008 Olympic period (8/8/08 – 9/24/08) compared to pregnancies with that month during the same dates in 2007 (8/8/07 – 9/24/07) or 2009 (8/8/09 – 9/24/09). We also estimated the change in birth weight associated with interquartile range increases (IQR) in mean ambient PM2.5, SO2, NO2, and CO concentrations during each pregnancy month. Results: We found that the birth weight of babies with their 8th month of pregnancy during the 2008 Olympics were on average 22.6g larger (95% CI = 5.4g, 39.8g) than babies having the 8th month in 2007 or 2009. IQR increases in PM2.5 (19.2 µg/m3), SO2 (1.77 ppb), CO (0.3 ppm), and NO2 (13.3 ppb) concentrations during the 8th month of pregnancy were associated with birth weight decreases of -15.4g (95% CI = -29.5g, -1.3g), -28.4g (95% CI = -41.3g, -15.5g), -24.1g (95% CI = -35.5g, -12.7g), and -24.7 (95% CI = -61.4g, 12.1g), respectively. Conclusions: This natural experiment suggests that even a short term decrease in air pollution late in pregnancy, in a normally heavily polluted city, can have impacts on the birth weight of babies. Further work is needed to understand what mechanisms mediate this response.

Abstract Number	**O-4-07-05**
Presenter	Maria Altomare, Caterina Ledda, Stefania Di Mauro, Giovanni Arena, Chiara Copat, Aldo E. Calogero, Enzo Vicari, Maria Fiore, Filippo Giacone, Margherita Ferrante*
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cross-sectional study

Vanadium biomonitoring and semen quality in a volcanic area (Mt. Etna): a cross – sectional study

Background While the essentiality of vanadium (V) for living organisms has yet to be established with certainty, V contamination has become an increasingly important environmental concern. In volcanic areas has been established an increased environmental concentration of V. Adverse effects depend of blood levels of this element, in particular it is now well established that V may be male reproductive toxicants. Aims Evaluate V levels in whole blood, seminal plasma, sperm and semen quality of a reproductive-age human cohort living in the province of Catania near Mt. Etna. Methods Thirty healthy men were recruited aged 20 to 37 years, living in volcanic area. Demographic characteristics, diet and lifestyle habits were obtained by a questionnaire. Vanadium levels of biological samples were analyzed by ICP-MS (Perkin Elmer Elan DRC.e). Semen quality (concentration, morphology and motility) was assessed according to WHO 2010 guidelines. Results Median levels of V in whole blood, seminal plasma and sperm were 5.86, 2.85 ug/L and 0.01 ug/g, respectively. In 68% of the sperm samples motility is slightly lower than the reference values. Conclusions The blood concentration of vanadium was higher than the average value 0.051µg/L, reference value of vanadium in blood found in a review paper. No reference values were available for seminal plasma and sperm.

Abstract Number	**O-4-07-06**
Presenter	Philip Lupo*, Elaine Symanski, Peter Langlois, Michael Swartz, Yi Cai, Wenyaw Chan
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Neighborhood environment and oral clefts: An assessment of air toxics and neighborhood-based socioeconomic position

Background: Cleft lip with or without cleft palate (CL±P) is one of the most serious birth defects, occurring in about 1 per 1,000 deliveries. While air pollution and neighborhood socioeconomic position (SEP) are believed to be associated with CL±P, to our knowledge, there have been no assessments of CL±P and "neighborhood environment," which takes into account both place-based measures of air pollution and SEP. Aim: Determine the association between neighborhood environment and CL±P. Methods: Data on 2,555 cases of CL±P and 14,735 controls delivered between 1999 and 2008 were obtained from the Texas Birth Defects Registry. Neighborhood environment was based on maternal census tract at delivery. Census tract-level estimates of ambient levels of lead, diesel particulate matter, and trichloroethylene were obtained from the United States (US) Environmental Protection Agency 1999 National-Scale Air Toxics Assessment. Neighborhood SEP variables drawn from the US Census 2000 included information on poverty, occupation, and education. Principal components analysis was used to create a composite neighborhood environment score (NES), which was categorized into quartiles representing low, medium-low, medium-high, and high exposure to adverse neighborhood environment. Mixed-effects logistic regression was used to evaluate the association between neighborhood environment and CL±P while adjusting for relevant individual-level covariates including maternal age, smoking, race/ethnicity, and education. Results: Mothers with CL±P-affected offspring were more likely to live in high NES (adverse) areas compared to mothers with unaffected offspring (odds ratio=1.16, 95% confidence interval: 1.02-1.32). There was a statistically significant trend with increasing exposure category (p=0.03). Conclusions: Using data from one of the world's largest active birth defects surveillance systems, we found that adverse neighborhood environment is modestly associated with CL±P.

Abstract Number	**O-4-08-01**
Presenter	DeKun Li*, Maohua Miao, ZhiJun Zhou, Chunhua Wu, Huijing Shi, Xiaoqin Liu, Siqi Wang, Wei Yuan
Exposure	organic compounds
Health domains	obesity
Type of research	cross-sectional study

Urine Bisphenol-A Level in Relation to Obesity and Overweight in School-age Children

Background: Bisphenol-A (BPA) is a potential endocrine disruptor impacting metabolic process and increasing the risk of obesity. Aims: To determine whether urine level is associated with overweight/obesity in school-age children. Methods: We examined 1,326 students grade 4-12 from three schools (one elementary, one middle and one high school). More than 98% of eligible students participated. Total urine BPA concentration was measured and anthropometric measures were taken by trained research staff. Information on risk factors for childhood obesity was collected as potential confounders. Age- and gender-specific weight greater than 90th percentile of the underlying population was the outcome measure. Results: After adjustment for potential confounders, a higher urine BPA level (≥ 2 µg/L), at the level corresponding to median urine BPA level in the U.S. population, was associated with more than two fold increased risk of having weight > 90th percentile among girls aged 9-12 (adjusted odds ratio (aOR)=2.32, 95% confidence interval: 1.15--4.65). The association showed a dose-response fashion with increasing urine BPA level associated with further increased risk of overweight (p=0.006 for trend test). Other anthropometric measures of obesity including hip and waist circumference) showed similar results. A same association was not observed among boys. This gender difference of BPA effect was consistent with findings from experimental studies and previous epidemiological studies. Conclusions: Our study provides additional evidence suggesting that BPA could be a potential environmental obesogen. Widespread exposure to BPA in the human population may also be contributing to the worldwide obesity epidemic in children and adolescents.

Abstract Number	**O-4-08-03**
Presenter	Marcella Warner*, Amelia Wesselink, Kim Harley, Asa Bradman, Katherine Kogut, Dana Boyd Barr, Brenda Eskenazi
Exposure	persistent organic pollutants
Health domains	obesity
Type of research	cohort study

In Utero DDT Exposure and Obesity and Metabolic Syndrome in Children of Farmworkers

Background: In utero exposure to endocrine disrupting compounds including dichlorodiphenyltrichloroethane (DDT) has been hypothesized to increase risk of obesity later in life. Aims: The Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study is a longitudinal birth cohort of low-income Latinas living in a California agricultural community. We examined the relation of in utero DDT exposure to obesity and metabolic syndrome at 9 years. Methods: We included 261 children with p,p'-DDT and p,p'-DDE concentrations measured in maternal serum collected during pregnancy (ng/g lipid) and complete 9-year follow-up data. Age- and sex-specific body mass index (BMI) Z-scores were calculated from WHO Child Growth Standards. Overweight/obese was defined as BMI Z-score ≥85th percentile for age and sex. Metabolic syndrome was defined by the International Diabetes Federation criteria for children <10 years, waist circumference ≥90th percentile for age and sex. Results: At 9 years, average BMI Z-score was 1.10 (±1.08), 56.3% of children were overweight or obese, and 42.2% had metabolic syndrome. In boys, a 10-fold increase in maternal serum p,p'-DDT was associated with BMI Z-score (adj-β=0.27, 95% CI 0.08, 0.46) and overweight/ obese status (adj-OR=2.3, 95% CI 1.1, 4.6), but not metabolic syndrome (adj-OR=1.7, 95% CI 0.98, 2.8). Also among boys, a 10-fold increase in maternal serum p,p'-DDE was associated with overweight/obese status (adj-OR=2.1, 95% CI 1.0, 4.3), but not with BMI Z-score (adj-β=0.22, 95% CI -0.03, 0.48) or metabolic syndrome (adj-OR=1.5, 95% CI 0.7, 2.9). Neither DDT nor DDE were related to any of the outcomes in girls. Conclusion: We found a significant positive relation between in utero DDT exposure and BMI Z-score and overweight/obese status of 9-year-old CHAMACOS boys. Continued follow-up through puberty will be informative.

Abstract Number	**O-4-08-04**
Presenter	Damaskini Valvi*, Maribel Casas, Michelle A Mendez, Ana Ballesteros-Gómez, Noelia Luque, Soledad Rubio, Jordi Sunyer, Martine Vrijheid
Exposure	organic compounds
Health domains	obesity
Type of research	cohort study

Prenatal Bisphenol A Urine Concentrations and Early Rapid Growth and Overweight Risk in the First Years of Life

Background: Increasing experimental evidence suggests that developmental exposure to bisphenol A (BPA) increases offspring weight gain later in life. However, this hypothesis has not yet been explored in prospective cohort studies. Aim: We examined the effects of maternal BPA exposure during pregnancy on rapid growth in the first 6 months of life and subsequent body mass index (BMI) and waist circumference at the ages of 14 months and 4 years. Methods: BPA concentrations were measured in two spot urine samples collected in the 1st and 3rd trimesters of pregnancy from mothers of the Spanish INMA birth cohort study (N=402). The average of the two creatinine-adjusted BPA concentrations was used as exposure variable. Rapid growth was defined as a weight gain z-score > 0.67 in the first 6 months of life. Child age-and-sex specific BMI z-scores were calculated at age 14 months and 4 years based on the WHO referent; overweight was defined as a BMI z-score ≥ the 85th percentile. Age-and-sex-specific waist circumference z-scores were calculated at age 14 months and 4 years using the analysis population mean. Results: Twenty-six percent of infants were rapid growers, 26% were overweight at 14 months and 21% at 4 years. BPA concentrations (GM±GSD) were 2.6 ± 2.3 in 1st and 2.0 ± 2.3 µg/g creatinine in 3rd trimester samples (Pearson r=0.13, p<0.01). At 4 years, associations were observed between BPA exposure and increased waist circumference (β z-score per log10 µg/g: 0.29; 95% CI: 0.01, 0.58) and BMI (β z-score: 0.27; 95%CI: -0.08, 0.62). BPA was not related to the obesity-related outcomes assessed at earlier ages. Conclusions: Findings suggest an association between BPA exposure and obesity-related outcomes in childhood, but not earlier in infancy. The short half-life and large within-person variability of BPA exposure create uncertainties in exposure assessment which may have biased results towards the null hypothesis.

Abstract Number	**O-4-08-05**
Presenter	Tiffany Yang*, John D. Meeker, Karen E. Peterson, Zhenzhen Zhang, Brisa N. Sánchez, Alejandra Cantoral Preciado, Martha Maria Tellez-Rojo Solis
Exposure	organic compounds
Health domains	obesity
Type of research	cohort study

In utero and peripubertal exposures to endocrine disrupting compounds on weight status and fat distribution at 8-13 years

Background: Exposures to the endocrine disrupting compounds (EDCs) bisphenol A (BPA) and phthalates have been linked to measures of child weight status in cross-sectional studies, but these do not capture the formative effects of early life exposures on adolescent anthropometry. Aims: We examined the association ofin utero and peripubertal exposures to BPA and nine phthalate metabolites with measures of weight status and fat distribution at 8-13 years of age. Methods: Among a preliminary analysis of 108 of 250 mother-child pairs from Mexico City, we estimated the effect of ln-transformed BPA and phthalates exposures from maternal third trimester and peripubertal urines on the continuous outcomes of weight, height, body mass index (BMI), and waist circumference (WC), adjusted for child's age, sex, maternal education, socioeconomic status, birth cohort, and specific gravity of urine. Analysis for tricep skinfolds (TSF) were stratified by sex and adjusted for child's age and specific gravity of urine. Reported preliminary coefficients retain a p-value<0.20. Results: Peripubertal MEP concentrations were suggestively associated with BMI (β=0.44; 1 ng/mL increase in ln-transformed peripubertal MEP exposure is associated with a 0.44 unit increase in age-and-sex adjusted BMI), WC (β=1.21), weight (β=1.23), and TSF (β=0.53) while MCPP concentrations were negatively associated with BMI (β=-0.78) and WC (β=-1.87). Sex differences were found for females within utero exposures to MBP (β=-1.03) and MBzP (β=-1.37) with TSF.In utero and peripubertal BPA exposures were not associated with measures of fat mass and distribution at 8-13 years. Conclusions: These intriguing preliminary results suggest that certain phthalate metabolites that may have effects on BMI and fat distribution in peripuberty, with differences by sex. These results, and the null findings for BPA exposure, necessitate further investigation in a larger sample size.

Abstract Number	**O-4-08-06**
Presenter	Thorhallur Ingi Halldorsson*, Panu Rantakokko, Dorte Rytter, Tine Brink Henriksen, Bodil Hammer Bech, Hannu Kiviranta, Sjurdur Frodi Olsen
Exposure	persistent organic pollutants
Health domains	obesity
Type of research	cohort study

Prenatal Exposure to persistent organochlorine compounds and offspring anthroprometry: A prospective study with 20 years of follow-up

Background: Animal studies have suggested that early life exposures to certain endocrine disruptors may interfere with pathways that regulate offspring later body weight. In humans these findings have mostly been explored with respect to persistent organochlorine compounds (POC) and weight gain early infancy and childhood. Aims:To examine the association between in utero exposure to polychlorinated biphenyls (PCBs) and organochlorine pesticides and offspring anthropometry at 20 years of age. Methods: A prospective cohort of 662 Danish pregnant women recruited in 1988-1989 with offspring follow-up in 2008-2009. PCBs (sum of congeners # 118, 138, 153, 156, 170, 180), dichlorodiphenyl-dichloroethylene (DDE) and hexachlorobenzene (HCB) were measured maternal serum from gestational week 30. Results: Maternal serum concentrations [median (interquartile range)] were 3.43 ng/mL (1.95) for sum of 6 PCBs, 0.54 ng/mL (0.28) for HCB and 2.46 ng/mL (2.2) for DDE. After adjustment for covariates, including serum lipids, parity, maternal socioeconomic status and pre-pregnancy body mass index (BMI), maternal serum PCB concentrations were positively associated (p for tend = 0.04) with female (n=344) offspring BMI at 20 years. Female offspring of mothers who were in the highest quartile of PCB concentration (≥4.9ng/mL) had on average 1.0kg/m2 higher BMI (95%CI: -0.1, 2.2) and 2.6 cm (95%CI: -0.7, 5.9) higher waist circumference compared to female offspring whose mothers were in the lowest quartile (≤1.1ng/mL). For female offspring, similar but more modest association were observed for HCB (p for trend = 0.07 for BMI), while no association was observed for DDE. No association was observed between maternal serum concentrations of PCB, HCB and DDE and male offspring anthropometry at 20 years (n=318). Conclusions: This long term follow-up study suggests that prenatal exposure to PCBs and HCB may be modestly associated with higher adiposity in female offspring at 20 years of age.

Abstract Number	**O-4-09-01**
Presenter	Hanneke Kruize*, Caroline Ameling, Marten Marra, Wim Swart, Oscar Breugelmans, Danny Houthuijs, Paul Fischer, Nicole Janssen
Exposure	green spaces
Health domains	other
Type of research	cohort study

Green space and all-cause mortality in the Netherlands

Background: Due to increasing urbanisation, green space in residential environments is under pressure. At the same time, there are indications that presence of green space is important for human health and well-being. However, most of this evidence is based on experimental and cross-sectional studies. In addition, there have only been few studies on green space and mortality. Aims: To assess the effect of green space in the vicinity of the home address on all-cause mortality in the Netherlands. Methods: Data on the amount of public and agricultural green space within 500 m of the dwelling were available from Dutch Land Use Statistics, year 2003. Eight green space categories were defined, ranging from <25 m2 to ≥ 10,000 m2. Mortality data for a follow-up period of 7 years (time period 2004-2010) were obtained from Statistics Netherlands for all inhabitants of age over 20 who had not changed address in the previous 5 years (~ 8 million inhabitants). These mortality data were regressed on green space estimates at the individual level, using Cox' proportional hazard models. Hazard ratios (HRs) were adjusted for age, gender, marital status, country of origin and standardised household incomefor the year 2001. Complete data were available for 7,679,251 million inhabitants. Results: Using the category with least green space as reference (< 25 m2), there was a decreasing trend in Hazard Ratios (from HR 0.99 for 25-99 m2; to 0.90 for 2,500-10,000 m2).With the exception of the first category, the results are statistically significant. Conclusion: We found that a larger amount of green space in the vicinity of the home address is associated with a lower all-cause mortality rate.

Abstract Number	**O-4-09-02**
Presenter	Payam Dadvand*, Bart Ostro, Margarita Triguero-Mas, Xavier Basagaña, Francesc Figueras, Antònia Valentín, David Martínez, Michael Jerrett, Mark J Nieuwenhuijsen
Exposure	green spaces
Health domains	reproductive outcomes
Type of research	case-control study

Buffering Effect of Residential Surrounding Greenness and Roadside Trees on the Association between Residential Proximity to Roads and Term Low Birth Weight

BACKGROUND: Maternal residential proximity to major roads has been associated to a range of adverse pregnancy outcomes; however, there is no available report on buffering effect of residential surrounding greenness or roadside trees on such an association. AIMS: To investigate the buffering effect of residential surrounding greenness and roadside trees on the association between maternal residential proximity to major roads and term low birth weight (LBW). METHODS: This study was based on 6487 singleton term births occurring in Barcelona (2001-05). We utilized satellite-derived Vegetation Continuous Fields (VCF) and Normalized Difference Vegetation Index (NDVI) to respectively abstract the averages of percent tree cover in a 30m buffer around major roads and NDVI in a 500m buffer around each home. We generated an indicator with three categories: 1) those women residing further than 200m of a major road (reference category), 2) those residing within 200m of greenest major roads (i.e. third tertileof roadside tree percentages) and 3) those residing within 200m from a less green major road (i.e. the first and second tertiles). We developed similar indicator for residential surrounding greenness based on NDVI tertiles. RESULTS: Compared to the reference category, there was a non-significant increase in the adjusted risk of term LBW for those women living within 200m of greenest major roads (OR=1.32 (0.85, 2.06)) or having highest surrounding greenness (OR=1.31 (0.81, 2.11)). This association became stronger and attained statistical significance for those living within 200m of major roads with lower roadside tree coverage (OR=1.52 (1.07, 2.16)) or homes with less surrounding greenness (OR=1.51 (1.07, 2.12)). Stratified analyses according to tertiles of roadside tree percentage or NDVI showed similar patterns. CONCLUSION: Roadside trees and residential surrounding greenness could buffer the association between residential proximity to major roads and term LBW.

Abstract Number	**O-4-09-03**
Presenter	Simon Kingham*, Daniel Nutsford, Amber Pearson
Exposure	green spaces
Health domains	mental health
Type of research	cross-sectional study

The influence of urban green space on mental health in Auckland, New Zealand

BackgroundAs urbanization is escalating globally, urban features which improve or hinder physical and, more recently, mental health are of growing importance. One area of investigation entails the health benefits of urban green spaces. This study examined the relationship between six different measures of green space access and anxiety/mood disorders in Auckland, the largest and fastest- growing city in New Zealand. MethodsAnxiety/mood disorder treatment counts by three age groups were aggregated to 3149 small area units in Auckland. Six measures of green space access were derived using GIS techniques involving total green spaces and useable green spaces. We fitted negative binomial regression models to test the relationship between access to green space and area-level anxiety/mood disorder, adjusted for age and area-level deprivation. ResultsAnxiety/mood disorders were associated with three green space measures. Access to total and useable green space within 300 meters did not exhibit significant associations, however access measures within 3km and distance to nearest useable green space both indicated a protective effect of increased access on decreased anxiety/mood disorders. ConclusionThis study found that proximity to useable green space and the proportion of green space within the larger neighbourhood was positively associated with decreased anxiety/mood disorders in an urban environment. This suggests the benefits of green space on mental health may relate both to the ability to participate in activities in parks near to the home and to visualization of green space in the neighbourhood environment.

Abstract Number	**O-4-09-04**
Presenter	Elmira Amoly*, Payam Dadvand, Joan Forns, Mònica López Vicente, Marta Cirach, Mar Álvarez Pedrerol, Jordi Julvez, Mark J Nieuwenhuijsen, Jordi Sunyer
Exposure	green spaces
Health domains	neurodevelopment
Type of research	cross-sectional study

Use of Green Spaces and Behavioral Indicators of Neurodevelopment in Schoolchildren

Background: Contact to green spaces has been associated with improved mental health and well-being; however, available evidence on the impact of green spaces on child behavioral development is scarce. Aim: To study the association between use of green spaces and behavioral indicators of neurodevelopment in primary school children. Methods: This study was based on a sample of 2407 schoolchildren (6-8 years) from 39 schools across Barcelona (2012) under the framework of BREATHE study. Parents were asked to fill a questionnaire including sociodemographic and household characteristics and child's frequency of green space use. Annual total time spent in green spaces was abstracted by multiplying the number of days and hours per day that children spent in green spaces during school days, weekends, and holidays. To evaluate the behavioral patterns we utilized Strengths and Difficulties Questionnaire (SDQ) filled by parents. We applied linear regression models to estimate the association between quartiles of the annual total time spent in green spaces and SDQ total and subscale scores, adjusted for parental education, occupation, marital status, and smoking, breastfeeding, child's sex, ethnicity, school level, and preterm birth. Results: Comparing the fourth quartile with the first quartile of annual total time spent in green spaces, we found a 0.9 (95% CI: 1.5, 0.3), 0.3 (95% CI: 0.5, 0.1), and 0.4 (95% CI: 0.5, 0.2) reduction in SDQ total, emotion, and peer scores respectively. For these associations we observed dose-response relationship across quartiles of annual time spent in green spaces. For hyperactivity, there was a dose-response relationship; however, the association for the fourth quartile was not statistically significant. For prosocial and conduct subscales the results were not conclusive. Conclusion: We found a moderate beneficial impact of contact to green spaces on behavioral development in schoolchildren, though adjustment for social context has not yet been completed.

Abstract Number	**O-4-09-05**
Presenter	J. G Cedeno-Laurent*, Chih-Da Wu, Eileen McNeely, Gary Adamkiewicz, Shih-Chun Candice Lung, Francesca Dominici, John D. Spengler
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	exposure modeling

Spatial relation between greenness and student performance in five cities of Massachusetts

Background Many disciplines have looked at the benefits of greenness in the urban context. Some of the identified advantages of vegetated areas are the improvement of air quality, mitigation of urban heat island effect as well as decrease of psychophysiological health related outcomes. The potential association between cognitive performance among children and their exposure to vegetation is still unexplored. Aims To test the hypothesis that vegetated areas in the proximity of schools in urban settings have a positive effect on the performance of the students. Methods This study uses the Composite Performance Index (CPI) of the English test scores from the Massachusetts Comprehensive Assessment System (MCAS) for all third grade elementary school groups in the five largest cities of Massachusetts. Surface vegetation cover was estimated using Normal Difference Vegetation Index (NDVI), on a 250 m2 spatial resolution. Generalized additive model (GAM) regressions with penalized spline analysis for NDVI was performed, controlling for socio-demographic variables at the school level. Results The results of the GAM regression indicate that a model including variables such as gender, race, limited English proficiency and income show a good fit. (Adj. R-sq=0.689). Concern about multicollinearity between the included variables was addressed (max VIF: income=5.3). The penalized spline analysis for NDVI resulted in a S-shaped dose-response curve (p-value=0.002) with 2 effective degrees of freedom. The computed effect of vegetation is stronger in the moderate range of NDIV (0.25, 0.4). Conclusions. Though the mechanistic effects of vegetation on student performance are difficult to prove, this first analysis of the combined databases offers suggestive evidence on the positive effect of vegetation on student performance. Addressing limitations such as lack of individual data as well as exploring additional confounding factors would lead to more a robust understanding of the proposed association.

Abstract Number	**O-4-09-06**
Presenter	Daniela Fecht*, Lea Fortunato, Anna Hansell
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

Associations between urban form and mortality rates in England and Wales

Background. Seventy-five percent of the population in Europe live in urban areas, so analysing the effects of urban form on health is of public health interest. However, research in recent years has focussed on health benefits of specific characteristics such as green space or walkability rather than multiple aspects of urban form. Aim. A novel approach was used to investigate associations between different measures of urban form and mortality risks in cities in England and Wales. Methods. An ecological, cross-sectional study was conducted for 54 cities with more than 200,000 residents. Linear regression models were used to examine the associations between city-level measures of urban form (distribution and density of population, land cover, transport networks, location, altitude range, city structure) and age-sex standardised risks of deaths from all causes (including accdients) and cardiovascular disease with adjustment for a a smoking proxy and area-level deprivation. Results.The most consistent pattern of associations were seen with transport network patterns, especially high junction density. Women <65 years living in cities with high junction density had a relative risk (RR) for CVD mortality of 1.16 (1.10-1.22) compared to those living in cities with the lowest junction density; corresponding risk for men was 1.12 (1.09 – 1.16). Relatives risks were higher with premature than all-cause mortality and in females compared with males. Smaller and less consistent associations could be detected with land cover or population patterns. Conclusion. Associations between urban form and mortality can highlight characteristics of city structure that potentially have negative effects on the health of urban communities. Further examination of urban form is warranted, to inform future urban planning and regeneration strategies including examination of different outcomes such as respiratory disease and road-traffic accidents.

Abstract Number	**O-4-11-01**
Presenter	Amal Saad-Hussein*, Fathy Abdelgelil, Karima El-Shamy, Madyha Mahmoud
Exposure	pesticides
Health domains	other
Type of research	occupational study

Study of liver health hazards in pesticides sprayers and the role of antioxidants supplementation

Background: Organophosphours pesticides represent more than 80% of total pesrticides used in Egypt. Several studies detected an alteration in the liver enzymes activities among occupational workers exposed to organophosphorus pesticides alone or in combination with organochlorine. The aim of the study was estimation of the impact of occupational exposure to organophosphorus pesticides on the liver and the oxidative antioxidants balance in male pesticides spray farmers, and evaluation of the ameliorative effects of antioxidants supplementation rich in Zn. Methods: ALT, AST, GGT, SOD, GPx, zinc and MDA were estimated in 46 pesticides sprayers before and after supplementation by antioxidants rich in zinc for two month. The results revealed that the liver, as well as oxidative-antioxidant balance were affected in the pesticides sprayers, and this affection increased with the increase in the duration of exposure. Antioxidants supplementation rich in zinc for two month was found to have significant improving effects on the liver functions, as well as on the oxidative-antioxidant balance in the pesticides sprayers. Conclusion: Organophosphorus pesticides cause oxidative stress that alter the liver enzymes and the antioxidants in the pesticides sprayers, and antioxidants supplementation rich in Zn improved these hazardous effects.

Abstract Number	**O-4-11-02**
Presenter	Ohad Zivan*, Michal Segal Rosenheimer, Yael Dobowski
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	exposure measurement

Atmospheric measurements and modeling of pesticides drift to communities adjacent to agricultural fields

Background: Extensive use of pesticide is an essential part of modern agriculture. However, there is growing concern regarding off-target contamination due to pesticide drift from treated fields, and exposure of adjacent rural communities. Pesticide drift includes both spray drift during application (Primary drift) and post-application drift (Secondary drift) mainly resulting from evaporation of the applied pesticide. Quantitative knowledge on pesticide drift is still lacking. Most research has focused on primary drift and deposition of airborne pesticide, while much less attention has been given to atmospheric transport of smaller aerosols and gaseous pesticides. The case is more severe for secondary drift, especially for hot and semi-arid climate. Aims: To assess, in semi-arid climate, primary and secondary drift of pesticide to rural communities adjacent to agricultural fields. Methods: Concentrations of airborne Chlorpyrifos and Dichlorvos (organophosphate pesticides) were measured during and after application in a community adjacent to a treated field (~70m from field edge) using high volume samplers equipped with quartz filters and polyurethane foam plugs for aerosols and gases sampling, respectively. In addition, pesticide drift during applications were simulated using non-steady state CALPUFF atmospheric modeling software. Results: Despite the distance from treated field, in all application events elevated atmospheric pesticide concentrations were observed during application (few µg*m-3) and in the following days (tens to hundreds ng*m-3). Modeling results predicted well the temporal trend but underestimated observed concentrations. Conclusions: Rural communities adjacent to treated fields are exposed to primary and secondary pesticide drift, resulting in inhalation exposure that may not be negligible. CALPUFF provides a useful tool to model pesticide primary and secondary drift, but emissions estimations from treated fields still need to be improved.

Abstract Number	**O-4-11-03**
Presenter	Lifang Hou*, Gabriella Andreotti, Sharon Savage, Jane Hoppin, Dale Sandler, Andrea A Baccarelli, Stella Koutros, Laura Beane Freeman, Michael Alavanja
Exposure	pesticides
Health domains	cancer
Type of research	cohort study

Telomere shortening among male applicators in the Agricultural Health Study

Background: Telomere length in surrogate tissues (i.e., blood or buccal cells) may be influenced by several different mechanisms associated with pesticide exposure. Aims: To determine if pesticides use is associated with telomere length. Methods: We examined buccal cell telomere length in relation to lifetime use of 48 pesticides for 1,234 cancer-free White male pesticide applicators participating in a prospective cohort study of 57,310 licensed pesticide applicators. Participants provided detailed information on lifetime use of 50 pesticides at enrollment (1993-7). Buccal cells were collected from 1999 to 2006. Relative telomere length (RTL) was measured using quantitative real-time PCR. Linear regression modeling was used to evaluate the associations between use of specific pesticides and the logarithm of RTL while adjusting for age at buccal cell collection, state of residence, applicator license type, chewing tobacco use, and total life-time days of all pesticide use. Results: The mean RTL for participants decreased significantly with increased life-time days of pesticide use for alachlor (P=0.002); 2,4-D (P=0.004); metolachlor (P=0.01); trifluralin (P=0.05); permethrin (for animal application) (P=0.02) and toxaphene (p=0.04). A generally similar pattern of RTL shortening was observed with the metric lifetime intensity-weighted days of pesticide use. For dichloro-diphenylchloroethane (DDT), significant RTL shortening was observed for lifetime intensity-weighted days (P=0.04), but not for lifetime days of DDT use (P=0.08). No significant RTL lengthening was observed for any pesticide. Conclusion: Seven pesticides previously linked to increased cancer risk in the epidemiologic literature, were inversely associated with RTL in buccal cell DNA among cancer-free pesticide applicators.

Abstract Number	**O-4-11-04**
Presenter	Denis Sarigiannis*, Periklis Kontoroupis, Ermioni Solomou, Spyridoula Nikolaki, Anastasios Karabelas
Exposure	pesticides
Health domains	cancer
Type of research	health impact assessment

Cancer risk due to pesticide use in Europe

Background Application of pesticides on crops has important and wide-ranging impacts on health. The major factors influencing emissions from pesticides are pesticide dosages, crop typology, areas cultivated by crops and trees and agricultural/forestry practices (e.g. pest control regime, fertilizer practices). Aims This work aims at developing an integrated methodology for assessing the health effects due to inhalation of pesticides, transported over relatively short distances in the EU – 27. The effect of carcinogenic Active Substances (AS) is assessed for a business-as-usual and a accounting for climate change and introduction of energy crops from 2010 to 2050. Methods Based on the AS emission inventory and mechanistic description of short-range transport in the air, intake rates per AS and related crop are calculated, using data on body weight and inhalation rate (stratified by age and gender). These intake rates are used to determine the rural population's cancer risk at a spatial resolution of 50x50km, by appropriate use of exposure response functions and the spatially resolved human exposure to AS from a particular crop. Considering that pesticide inhalation occurs near its application, incidence rates are computed at a finer spatial resolution (100x100m) and then results are aggregated at country level. Results Atmospheric emission of pesticides varies significantly across Europe. Different pesticide families are emitted from different parts of Europe as a function of the main crop(s) cultivated, agro-climatic conditions and production intensity. The European countries that face the biggest problem from pesticides are Spain, Romania and Hungary, Germany and Italy. Conclusions Near-field exposure is more important than most other routes with the exception of dietary intake in heavily contaminated areas. Climate change adaptation/mitigation policies are expected to modify the spatial patter of exposure and associated cancer risk resulting in an overall slightly higher attributable risk.

Abstract Number	**O-4-11-05**
Presenter	Prakash Behere*, Anweshak Das Das, Manikyamba Behere
Exposure	pesticides
Health domains	mental health
Type of research	case-control study

Pesticide exposure and suicidal ideation in rural communities of Wardha district of Central India.

1. Background In India, 70% of population lives in villages. Approximately 58% of total workers is still dependent on agriculture either as cultivators or agricultural labourers. Most common methods of suicide are by consumption of pesticides. Majority of villagers are farmers few works in industries and other places. Most common pesticide used in India is Organophosphate. Endosulfanis still used in India but have been banned in manyWestern nations. In view of this factor the study was conducted Aims To find out association of suicidal ideation and pesticide exposure as compared to villagers who are not exposed to it. 2. Methods Study Design: It is a cross sectional comparative study. Study setting: Study was conducted in rural community of Wardha district in Central India. Sample size: 78 farmers were included in the study who were exposed to pesticides. Age, sex matched 78 controls who were not exposed to pesticides. Sampling procedure: samples were randomly selected. Tools used: Indian Version of Self Reporting Questionnaire (SRQ) Including criteria: Farmers were included for the study group who are exposed to pesticides.Control group were villagers belonging to other professions included who are not exposed to pesticides . Excluding criteria: Farmers having prior psychiatric illness and suicide in family. 3. Results: It was found in the study that 30% of the study sample (i.e. farmers included in the study exposed to pesticide) was having suicidal ideation as compared to control group 8% of the sample had suicidal ideation. It is also noticed that those who got suicidal ideation were having depressive symptoms as well on SRQ as compared to controls. 4. Conclusion: Is it depressive symptoms which cause suicidal ideation or both are independent as compared to those who are not exposed to insecticides. It is likely that pesticide exposure may be associated with suicidal ideation. Organic farming is the demand of the future.

Abstract Number	**O-4-11-06**
Presenter	Fatima Hamad*
Exposure	pesticides
Health domains	cancer
Type of research	case-control study

Occupational and Prostate Cancer Risk

Background: The rapidly increasing incidence of prostate cancer in Sudan calls for attention to the etiology and prevention of this type of cancer in old men. Potential risk factors that are mentioned in Sudanese prostate cancer patients are age, education level, unhealthy habits, the body mass index and occupation. Aim: to assess occupation’s exposure as risk for prostate cancer. Methods: A population-based case–control study recruited 237 men with a diagnosis of confirmed prostate Cancer and 237 controls randomly selected from the community between 1/Jan/2008 to 30/December/2010 in Gezira state-Central of Sudan. Thirteen occupations and 8 industries were selected for analyses to estimate the odds ratio between each occupational circumstance and prostate cancer with control for potential confounders. Results: History of farmer was associated with a highly significant increased the risk for prostate cancer OR (3.711; 95% CI, 2.722-5.058), as was exposure to pesticides was associated with a highly significant increased OR (3.512; 95% CI, 2.611-4.725, P <0.000). Agriculture industry were strongly significantly elevated the risk for prostate cancer, as well as miscellaneous services wasn’t associated but it had significant affected OR (3.439and 0.506; respectively, P < 0.000). Farmer and Horticulturalists, mixable workers and Businessmen are relatively high odds ratios; also these are high statistically significant (P < 0.000). Conclusions: These results suggest positive associated was appeared between some occupations, industries and increased the risk for prostate cancer in Sudan. Furthermore it needs more attention to preventing and curing the agriculture community.

Abstract Number	**O-4-12-01**
Presenter	Eleni Papadopoulou*, Marina Vafeiadi, Maria Botsivali, Marie Pedersen, Harrie Besselink, Leda Chatzi, Kristine B Gutzkow, Lisbeth E Knudsen, Laura J Hardie, Manolis Kogevinas, Margaretha Haugen
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

Maternal dioxin-dietary patterns, prenatal exposure to dioxins and dioxin-like compounds, and birth outcomes in a European Mother-Child Study (NewGeneris)

Background Diet is the main source of exposure to dioxins and dioxin-like compounds for the general population. The diet of pregnant women may affect exposure of the foetus to environmental contaminants and influence foetal growth. Aim We investigated the association between maternal diet and biomarker assessed dioxin levels in maternal and cord blood with birth outcomes in a European prospective mother-child study (NewGeneris). Methods Plasma dioxin-like activity was estimated by the Dioxin-Responsive Chemically Activated LUciferase eXpression (DR-CALUX) bioassay in maternal (n=604) and cord (n=198) blood samples collected at delivery in Denmark, England, Greece, Norway and Spain. We used food frequency questionnaires to assess maternal diet and reduced rank regression to identify two dioxin-dietary patterns related to maternal and cord blood dioxin levels (in DR-CALUX TEQ pg/g lipid), respectively. The dioxin-dietary pattern scores described participants' adherence to each of the two dietary patterns. Results The dioxin-dietary pattern score was positively correlated with dioxin (DR-CALUX) levels in cord blood (rho=0.35, p<0.001) and was characterised by high maternal consumption of red and white meat, low-fat dairy and fast-food and low consumption of fatty fish and high-fat cheese. Dioxin-dietary pattern score in the upper tertile was associated with a reduction of half week in gestational age (95%CI:-1.0 to 0.0) and a non-significant reduction of 73 grams in birth weight (95%CI:-237 to 90) compared to the lower tertile, after adjustment for confounders. Similar negative adjusted associations with birth outcomes were observed for the dioxin-dietary score that was linked to dioxin (DR-CALUX) levels in maternal blood. Conclusions Maternal diet contributes to the exposure of the foetus to dioxins and dioxin-like compounds. We provide evidence that a dioxin-rich diet may be related to reduced gestational age and birth weight, mediated by high prenatal exposure to dioxin and dioxin-like compounds.

Abstract Number	**O-4-12-02**
Presenter	Randi Bertelsen*, Anne Lise Brantsæter, Maria Christine Magnus, Margaretha Haugen, Ronny Myhre, Bo Jacobsson, Matthew Longnecker, Helle Margrete Meltzer, Stephanie J. London
Exposure	food
Health domains	allergies
Type of research	cohort study

Prospective Study of Maternal and Infant Consumption of Probiotic Milk and Allergic Disease: The Norwegian Mother and Child Cohort

Background: Whether probiotics, which can influence the microbiome, prevent infant eczema or allergic diseases remains an open question. Most studies have focused on high-risk infants. Aims: To assess whether consumption of probiotic milk products protects against atopic eczema, rhinoconjuctivitis, and asthma in early childhood in a large population-based pregnancy cohort (The Norwegian Mother and Child Cohort Study). Methods: We examined associations between consumption of probiotic milk products in pregnancy and infancy with questionnaire-reported atopic eczema, rhinoconjuctivitis, and asthma in 40,614 children. Relative risks (RR) were calculated using general linear models, adjusted for potential confounders. Results: Consumption of probiotic milk in pregnancy was associated with a slightly reduced risk [(adjusted RR (aRR)] of atopic eczema at 6 months aRR=0.93 (95% CI: 0.88, 0.99) and of rhinoconjuctivitis between 18 and 36 months, aRR=0.88 (95% CI: 0.78, 0.98) compared with no consumption during pregnancy. Maternal history of allergic disease did not notably influence the associations. When both mother (during pregnancy) and infant (after 6 months of age) had consumed probiotic milk, the adjusted relative risk of rhinoconjunctivitis was aRR=0.80 (95% CI: 0.69, 0.94) relative to no consumption by either. Probiotic milk consumption was not associated with asthma at 36 months. Conclusions: In this population-based cohort, consumption of probiotic milk products was related to a reduced risk of eczema and rhinoconjuctivitis. Our findings indicate that probiotic intake may be beneficial for the prevention of atopic eczema and rhinoconjuctivitis in the general population of children who mostly have no genetic predisposition for allergic disease development.

Abstract Number	**O-4-12-03**
Presenter	Ondine von Ehrenstein*, Marie Flores, Hilary Aralis, Beate Ritz
Exposure	food
Health domains	allergies
Type of research	cohort study

Urban Food Environment: Prenatal Fast Food Increases Risks for the Development of Asthma in Childhood

Background: Asthma in children is a global problem. Yet, knowledge about risk factors for the development of child asthma is limited. Fast food restaurants have rapidly increased in growing urban areas globally. No study to date has reported on prenatal fast food (FF) intake in relation to child asthma. Aims: To investigate whether consumption of FF during pregnancy increases the risk for asthma in children in an urban environment. Methods: From 58,316 birth records for children born in 2003 to mothers residing in 111 Los Angeles County zip codes, we selected cases of low weight (<2500g) and preterm birth (PTB) (<37 weeks) and an equal number of randomly sampled controls (≥2,500g/term). We conducted a survey 3-6 months after birth with 2543 of the 6374 women originally sampled from the cohort asking about FF consumption, demographic and pregnancy-related variables. Of 2438 women who participated in the survey and agreed to being recontacted, 1201 were located and participated in a follow-up in 2006; child asthma/wheeze were assessed using the ISAAC asthma questions. Poisson regression models with robust error variance using a log link function were used to estimate relative risks (RR). Results: Maternal intake of FF during pregnancy increased risks for child wheeze in a dose dependent manner: 'once a month': RR: 1.09 (95%CI: 0.71, 1.68), 'once a week': 1.38 (0.93, 2.6); '3-4 days a week': 1.84 (1.21, 2.79); 'every day' 2.33 (1.40, 3.87) compared to 'never', adjusting for potential confounders, including maternal asthma, race/ethnicity, PTB, and measured PM2.5 and ozone during pregnancy. Corresponding estimates for doctor's diagnosed asthma similarly increased (0.99 (0.46, 2.11); 1.15 (0.57, 2.34); 1.80 (0.85, 3.78); 3.22 (1.29, 8.01)) with increasing maternal FF intake. Conclusions: Our finding of increased child asthma risk following frequent FF consumption in pregnancy suggests a frequent and preventable risk factor in urban areas globally, and calls for further investigation.

Abstract Number	**O-4-12-04**
Presenter	Marisol Castillo-Castrejon*, Lauren Bylsma, Adriana Castañon-Figueroa, Miatta Buxton, Marie S O´ Neill, Felipe Vadillo-Ortega
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

DESCRIPTION OF THE INTAKE PATTERN OF FOODS CONTAINING GENOTOXIC COMPOUNDS BY MEXICAN PREGNANT WOMEN

Background The prenatal period represents a stage of susceptibility during which exposures can affect the fetus. Exposure of pregnant women to pollutants such as polycyclic aromatic hydrocarbons (PAHs) and heterocyclic aromatic amines (HCAs) have been associated with an increased risk of intrauterine growth restriction and preterm birth. Foods can contribute to total exposure during pregnancy. Aims The aim of this study was to describe the intake pattern of foods containing genotoxic compounds in pregnant women of low socioeconomic status. Methods Food frequency questionnaires (FFQ) were administered to 270 pregnant women residing in Mexico City during prenatal follow up. The FFQ included 126 food items; 44 food items were considered to be a source of PAHs/HCAs. Data represent weekly intake. Clinical, air pollution, and nutrition data was also collected. Patients were stratified by time spent watching television. Results The overall mean intake of foods containing PAHs/HCAs was 7.4 times per week. Mean intake of PAH/HCAs containing foods by categories was: 0.85 (fresh fruits and vegetables) 4.3 (grilled meats), and 2.3 (other foods) times per week. Specific PAHs/HCAs containing foods most frequently consumed included fried sausage, fried egg (3 times more frequent), deep fried corn/bean appetizers, fried chips, and canned tuna. Women who spent >4 hours daily viewing television consumed fast foods (p>F=0.021), meats (p>F=0.0334) and PAHs/HCAs containing foods (p>F=0.0358) more frequently than women who spent less time viewing television. Conclusions These pregnant women consume foods containing genotoxic compounds at least on a daily basis, and may therefore expose the developing fetus to PAHs/HCAs. Future analyses will evaluate associations of consuming foods that contain genotoxic compounds with preterm birth, accounting for exposure to air pollution, tobacco smoke, antioxidant vitamins intake.

Abstract Number	**O-4-12-05**
Presenter	Marie Pedersen*, Michelle A Mendez, Bernadette Schoket, Roger W Godschalk, Lisbeth E Knudsen, Gunnar Brunborg, Laura J Hardie, Leda Chatzi, Jos C Kleinjans
Exposure	food
Health domains	cancer
Type of research	cohort study

MATERNAL, DIETARY AND ENVIRONMENTAL PREDICTORS OF BULKY DNA ADDUCTS IN CORD BLOOD: A EUROPEAN MOTHER–CHILD STUDY (NEWGENERIS).

Background: Bulky DNA adducts in cord blood reflect prenatal effective dose of exposure to genotoxic compounds such as polycyclic aromatic hydrocarbons, provide a reliable biomarker of genotoxic damage and possibly cancer risk. Little is known on sources of exposures resulting in these adducts particularly in neonates. Aims: We examined maternal, dietary and environmental predictors of bulky DNA adduct levels in neonates to better understand our previous finding of an association between higher adduct levels and lower birth weight. Methods: Pregnant women from Greece, Spain, England, Denmark and Norway were recruited in 2006-2010. Adducts were measured by the 32P-postlabelling technique in cord white blood cells (n=511). Maternal diet and other personal characteristics were assessed via questionnaires. Land-use regression models were used to estimate individual exposure to air pollution. Results: Adduct levels tended to be higher in neonates born to women who smoked as compared with those of non-smokers (10.0 (n=81) vs. 7.6 (n=424) adducts per 108 nucleotide, p=0.10). Spanish and Greek neonates had higher adduct levels than the Northern Europeans (12.7 (n=237) vs. 7.0 (n=373) adducts per 108 nucleotides, p<0.001). Neonates born during June-August had the highest adduct levels. Higher maternal pre-pregnancy body-mass index, births during June-August, and high maternal intake of cured and smoked meat was associated with higher adduct levels (p<0.05). A protective effect of maternal intake of fruits rich in vitamin C was also found (p=0.03). Ambient air pollution (PM2.5) at the home address during pregnancy was not associated with adduct levels in Greece and England. Estimation of air pollution is ongoing in the other countries and a complete analysis will be presented. Conclusions: These findings suggest that prenatal exposures from maternal lifestyle and so far unknown country-specific factors influence the bulky DNA adduct formation in neonates. Acknowledgement: NewGeneris and ESCAPE (EU FOOD-CT-2005-016320 and 211250).

Abstract Number	**O-4-12-06**
Presenter	Fabienne Pelé*, Emma Bajeux, Hélène Gendron, Christine Monfort, Florence Rouget, Luc Multigner, Jean-François Viel, Sylvaine Cordier
Exposure	food
Health domains	allergies
Type of research	cohort study

Maternal seafood consumption and respiratory and allergic outcomes in preschool children.

Background: Environmental exposures, including dietary contaminants, may influence the developing immune system. Aims: This study assesses effects of maternal seafood consumption during pregnancy on the occurrence of wheezing and allergy in preschool children. Both fish and shellfish were studied since they differ according to their fatty acid (ω 3) content with anti-allergic properties, and their concentration of allergenic pollutants or toxins. Methods: The PELAGIE cohort included 3421 women recruited at the beginning of pregnancy. Maternal fish and shellfish intake was measured at inclusion by a food frequency questionnaire. Wheezing and allergy (atopic dermatitis and food allergy) were evaluated by questionnaire to the mother when the child was 2 years old (n = 1505). Estimation of the association between seafood intake and outcomes took into account major confounders like familial history of asthma and/or allergy, sex, pre-term birth, small-for-gestational-age, maternal age, parity, smoking during pregnancy, postnatal parental smoking at home, daycare attendance, breastfeeding. Results: Moderate maternal fish intake during pregnancy (1 to 4 times a month) was associated with a lower risk of wheezing (OR=0.64 [0.42-0.98]) before age two compared to low intake (<once/month). Shellfish consumption of at least once a month was associated with a higher risk of food allergy before age 2 (OR=1.57 [1.06-2.32]) compared to non or weak consumers (<once/month). Discussion/Conclusion: These results suggest that different categories of seafood may be differently associated with respiratory and allergic outcomes. In agreement with the literature, a moderate maternal fish intake appears negatively linked with wheezing. This study suggests for the first time that prenatal exposure to shellfish contaminants may increase the risk of food allergy.

Abstract Number	**O-4-14-01**
Presenter	Nicky Pieters*, Gudrun Koppen, Michelle Plusquin, Sofie De Prins, Bianca Cox, Vera Nelen, Luc Int Panis, Greet Schoeters, Martine Van Poppel, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Children's blood pressure in association with exposure to ultrafine particulate air pollution at school

Background: Ultrafine particles (UFP) may contribute to the cardiovascular effects of particulate air pollution, partly because of their relatively efficient alveolar deposition and potential to cross the lung blood barrier. Aim: The present study examines the association between blood pressure and particulate air pollution (<PM2.5) and UFP. Methods: In 130 children, aged 6-12 years, blood pressure (BP) was measured before noon (9-12 am). BP was measured after 5 minutes of sitting rest (5 consecutive measurements), using an automated device (Stabil-O-Graph, IEM, Stolberg, GE). Each child was examined twice (periods were 26 weeks apart). Ambient concentrations of PM2.5 and UFP were measured at the school's playground from 8 to 10 am. UFP was measured with a scan mobility particle sizer (SMPS, range: 2.5 to 1000 nm), PM2.5 with a Partisol filter. We used mixed models to account for gender, age, BMI, ambient temperature, heart rate and period (first or second examination). Results: Systolic (SBP) and diastolic (DBP) blood pressure averaged 105.5 and 60 mmHg, respectively. Mean PM2.5 concentration amounted 23 µg/m3 and 7413 particles/m3 for UFP. Independent of gender, age, BMI, heart rate, period and ambient temperature, each interquartile range (IQR) increase in total UFP in the morning of the examination was associated with 2.14 mmHg (95% CI: 0.68 to 3.62; p=0.0044) higher systolic blood pressure. The corresponding estimate for diastolic blood pressure was an increase of 1.46 mmHg (95% CI: 0.27 to 2.65; p=0.017). The smallest UFP fraction (20-30 nm) appeared to have a larger influence on BP, with a 3.03 mmHg (95% CI: 1.20 to 4.87; p=0.0014) increase in SBP and 1.95 mmHg higher DBP (95% CI: 0.43 to 3.47; p=0.012). SBP and DBP were not significantly associated with morning PM2.5 levels. Conclusion: Morning UFP levels at the school's playground were associated with children's blood pressure, while fine particulate air pollution was not.

Abstract Number	**O-4-14-02**
Presenter	Dennis Tolsma, Amber Sinclair*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

GLM MODELING OF THE RELATIONSHIP OF AIR POLLUTANTS TO CHILDHOOD AND ADULT RESPIRATORY DISEASES, BASED ON PRIMARY ACUTE VISITS BY HMO MEMBERS, 1998-2008

Background: Studies have shown differences in the biological responses to air pollution between children and adults. However, improved understanding is needed of air pollutants' role in less severe, but acute health outcomes for children and adults. Aims: To examine whether differences exist in the associations between air pollutants and respiratory disease acute outcomes for children and adults in primary care. Methods: Daily acute visit data for adult and childhood asthma, upper and lower respiratory infection, from Aug 1, 1998 - Jul 31, 2008, are from a non-profit managed care organization in Atlanta, GA, USA. Acute visits were defined as appointments made on the same day the visit was completed. Air pollution data are from a centrally-located air monitoring site for the Aerosol Research and Inhalation Epidemiology Study (ARIES)--PM2.5, PM10, Coarse PM, OC, EC, PM2.5 water-soluble (ws) metals, coarse ws metals; PM2.5 Zn, ws Cu, ws Fe, and ws Mn; and coarse PM ws Cu, ws Fe, and ws Mn. Poisson GLM was employed to determine the relationships between lagged pollutants (0-2, 3-5, and 6-8 day moving averages) and acute visits, controlling for time and weather variables. Results: Several pollutants were significant for childhood asthma, while only a few were significant for adult asthma. All of the childhood asthma significant findings were positive associations, with RRs (95% confidence interval) ranging from 1.022 (1.001-1.043) for CO to 1.045 (1.020-1.069) for coarse PM ws Mn. Similarly, more pollutants were significant for childhood URI compared to adult URI, with most of the adult URI significant findings being negative. There were also several significant pollutants for childhood LRI, but the majority of these had negative associations. Conclusions: The childhood age group has more significant pollutants than for adults, in all categories of respiratory disease.

Abstract Number	**O-4-14-03**
Presenter	Annibale Biggeri*, Dolores Catelan, Gaetano Dongarrà, Daniela Varrica, Daniele Grechi, Franca Rusconi, Riccardo Pistelli, Fabio Barbone, Neil Pearce
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

ASTHMA SYMPTOMS AND METAL COMPOSITION OF FINE PARTICLE AIR POLLUTION. PANEL STUDY IN CHILDREN LIVING IN THE MILAZZO–VALLE DEL MELA (ITALY) HIGH-RISK AREA

Background: the Milazzo–Valle del Mela high risk area contains oil refinery, petrochemical plant, oil-powered energy plant. Descriptive epidemiological data from the Sicilian Epidemiological Observatory documented higher than expected occurrence of respiratory diseases. Aims: we designed a panel study in asthma-symptomatic children to evaluate the association between spirometric measurements (FEV1), bronchial allergic inflammation (FeNO) and daily fine particles (PM2.5) concentrations and metal composition. Methods: first a survey among all 2506 children (6-10 years old) attending the primary schools in the area was conducted on 2006 using parents questionnaire. Then a panel study of 154 children positive for asthma symptoms was conducted (April-May 2007). Concurrently, we measured PM2.5 concentrations by gravimetric monitor in a central location within the study area. Metal composition was determined by inductively coupled mass spectrometry at CFTA, University of Palermo. Multivariate regression models of FEV1, and FeNO on PM2.5 concentrations and metal composition were fitted. We adjusted for socio-demographic and physical characteristics, day of the week, exposure to environmental tobacco smoke and major risk factors, drugs, atopy, recent respiratory infections, outdoor temperature and relative humidity. Results: Out of the 154 children enrolled in the study, 129 complied (83.8%) for 1057 valid measurements for spirometric variables and 1370 measurements for Fractional exhaled Nitric Oxide. We observed a 19% (90% CI 12–28%) decrease in FEV1 and a 45% (90% CI: 7–83%) increase in FeNO for a 10 mcg/cm increase in PM2.5 at lag 0 when temperature was below 10 °C and relative humidity between 60–80% (interaction chi-square 4 df = 29.77, $p < 0.0001$ for FEV1 and 7.55, $p = 0.1096$ for FeNO). We found evidence of effect for Vanadium (10% decrease in FEV1 at lag 0, 90% CI 0-20%). Conclusions: Exposure to PM2.5 from the industry was associated with lung function. A consistent effect of Vanadium was reported.

Abstract Number	**O-4-14-04**
Presenter	Maayan Yitshak-Sade*, Itzhak Katra, Rafael Gorodischer, Lena Novack, Victor Novack
Exposure	ambient air pollution
Health domains	allergies
Type of research	case-crossover study

Non-anthropogenic Dust exposure and Asthma Symptoms in Children

Background:Studies have shown a positive association between air pollutants and asthma in children. The Negev desert (Israel) is frequently subjected to dust storms (DS) originating from arid soils. The evidence regarding the association with non-anthropogenic PM due to DS is limited. Aims:To assess the impact of DS on asthma/wheezing hospitalizations and asthma medications utilization. Methods:We identified children admitted to Soroka University Medical Center (SUMC, serving a population of 261,600 children in Negev) during 2001-2011 with asthma or wheezing. Meteorological and air-pollution data were obtained. An air-polluted day was defined as a day with a PM10 concentration two standard deviations above the background. We used a case crossover analysis with conditional logistic regression for hospitalizations and time series analysis (GLM and GAM models) for asthma medications purchase assessments. Results:3,481 children were admitted (5,304 hospitalizations), 62% were males and 52.5% under two years. The average admissions number was 1.04/day, with higher incidence during the winter season (1.5/day). The number of DS days was 461 (12%). DS increased the risk for the same day hospitalization by 1.09 (95%CI 0.99-1.20, P=0.08), adjusted for seasonality, temperature, relative humidity and SO2. Exclusion of children with respiratory infections did not change the inference. In the spring-summer the association was stronger (odds ratio [OR]=1.43, 95%CI 1.42-1.72, P=0.01). In analysis by ethnicity, the positive significant effect was shown only among Bedouin Arabs (OR=1.93, 95%CI 1.04-1.35, P=0.008). Asthma medications purchase was 15% higher in DS days (95%CI 17-23%, P<0.01). Conclusion:The high PM10 levels during DS days increase the risk for asthma hospitalizations and purchasing of asthma medications among children, mostly in the spring and summer seasons. Bedouin children are at greater risk, partially due to residing in non-permanent dwelling conditions.

Abstract Number	**O-4-14-05**
Presenter	Ana M. Vicedo-Cabrera*, Ana Esplugues, Carmen Iñiguez, Marisa Estarlich, Ferran Ballester
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Health effects of the 2012 Valencia (Spain) wildfires on children in a cohort study

BACKGROUND: During July 2012, two simultaneous wildfires devastated near 50,000 hectares of forests covering the rural area of the INMA-Valencia cohort in Spain. The wildfires produced heavy smoke that affected the whole study area during several days. METHODS: Two weeks after the extinction of the wildfires, a phone survey was performed. It consisted on several questions about respiratory symptoms during the period when wildfires were active (June 28th – July 8th) and during a control period just before wildfires (June 16th – 27th). Information about the adoption of preventive measures, perception of smoke smell and presence of ashes was also collected. A conditional logistic regression was performed with the aim of estimate the effect of wildfires (control period vs wildfires' period). RESULTS: 496 families were surveyed (response rate of 85%). It was observed a significant increase in the percentage of children with itchy or irritated eyes (from 3.7% during the control period to 9.7% during wildfires, p-value <0.001) and sore throat (from 2.6% during the control period to 6.5% during wildfires, p-value <0.01). More than a half of the families closed the windows during almost once during the wildfires period, and 12.3% during the whole case period. 38% of the children spent less time than usual outside their homes. Near the 80% of the families perceived smoke smell outdoors and 40% indoors. Forty percent reported having observed that the air was so thick that they could not see more than a few blocks, and more than 90% of the families observed the presence of ashes in the air.An odds ratio (OR) of 3.50 (95% confidence interval (CI): 1.84-6.65) for itchy or irritated eyes and 2.73 (1.37-5.44) for sore throat were obtained. Even more elevated OR were obtained when families reported perceiving smoke smell indoor and outdoor, or dense smoke near homes. CONCLUSION: Exposure to wildfires's smoke was associated with increased respiratory symptoms in our children population.

Abstract Number	**O-4-14-06**
Presenter	Arina Petrosian*, Olena Turos, Oksana Ananyeva, Vasyl Zagorodniy, Ludmyla Chernenko
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

RISK OF ASTHMATIC MORBIDITY IN CHILDREN EXPOSED TO SULFUR DIOXIDE INDUSTRIAL EMISSIONS

Background/Aims. Nearly 20-30 % of all respiratory disorders and 40 % of asthma cases are the outcomes of intensive ambient air pollution. Therefore, environmentally predetermined respiratory diseases, and bronchial asthma in particular, are the subject of interest in environmental health research.This study analyzes asthmatic morbidity among children exposed to high levels of SO2 industrial emissions. Methods. Exposure assessment was conducted based on SO2 concentrations modeled with a Gaussian dispersion model (ISC-AERMOD). The total number of receptor points was 152 with 500 m spacing. Demographic data was analyzed and processed with GIS tools for 13,198 residential postal addresses. In GIS environment SO2 pollution maps and child population distribution data were overlaid to define the child groups living within areas of increased SO2 exposure. Child bronchial asthma morbidity data from 2001 to 2012 was analyzed in accordance with existing statistical and epidemiological approaches. Results. The results of the study showed that ambient SO2 levels were at Cmean=107±38 mkg/m3. However, even short-term variations in exposure to lower concentration of SO2 (50 mkg/m3) is able to provoke negative health effects in exposed group. It was revealed that 29176 children, which is 98% of the mapped child population within the city, were exposed to very high SO2 levels and lived in the zone of high health risk (HQ=1,6÷4,5). The prevalence of the disease was estimated at 100 cases per 10,000 of the population (95% CI; 87.5-111.5). It was revealed that children living in the zones of increased health risks attributed to SO2 are more likely to develop bronchial asthma than unexposed ones (1,99 OR; 95% CI(1,95-2,60), p<0,01). Conclusion. Overthecity, SO2 exposure is responsible for 30.5 % of asthma cases among the exposed child population. Proposals regarding management of the clinical records and organization of preventive medical examination among children were worked out and submitted to the city's public health department.

Abstract Number	**O-4-15-01**
Presenter	Michal Kicinski*, Jan Vrijens, Griet Vermier, Elly Den Hond, Greet Schoeters, Vera Nelen, Liesbeth Bruckers, Isabelle Sioen, Willy Baeyens, Nicolas Van Larebeke, Tim S. Nawrot
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Neurobehavioral function and low-level metal exposure in adolescents: suggestive evidence of an association between blood copper and attention

Background It is widely acknowledged that an excessive metal exposure is harmful to the brain. However, many aspects of metal neurotoxicity remain unclear including a determination of the magnitude of the low-level exposure effects and the establishment of exposure levels which can be assumed safe. Attention and the motor function are important targets of metal neurotoxicity. Aims To investigate the association between metal exposure indicators (in blood: copper, cadmium, lead, manganese, thallium; in urine: arsenic, cadmium, nickel; in hair: methylmercury) and the neurobehavioral endpoints attention and motor speed in a group of 606 adolescents between 13.6 and 17 years of age. Methods We applied structural equation modeling, a statistical method that allows to account for measurement errors and to specify a model in terms of causal relationships. Our models took into account gender, age, socio-economic status, education of mother, education of father, and smoking behavior of the adolescents. A quadratic model was applied for the essential elements copper and manganese and a linear model for the remaining metals. Results We observed an inverted U-shape association between copper exposure and attention, p=0.002. The highest attention scores was estimated for a whole blood copper concentration of 543 µg/L (95% CI: 300-983). For a whole blood copper concentration of 1035 µg/L (the 95th percentile), the attention score was 0.50 standard deviation lower compared to the optimum level. Lead, methylmercury, toxicologically relevant arsenic, manganese, cadmium, thallium, and nickel did not show a significant association, neither with attention nor with manual motor speed. Conclusions Blood copper and attention showed an inverted U-shape association in adolescents. Our study did not provide evidence of neurotoxicity from other metals. Our results are in line with recent evidence based on adults and elderly suggesting that copper might be relevant for the neurobehavioral function in humans.

Abstract Number	**O-4-15-02**
Presenter	Birgit Claus Henn*, David C. Bellinger, Maitreyi Mazumdar, Brent A. Coull, Linda Valeri, Rebecca Jim, David C. Christiani, Robert O. Wright
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to multiple metals and associations with neurodevelopment

Background: Few studies have evaluated the impact of mixed exposures to multiple metals on childhood development. Mixtures may be particularly important at low-level exposures, because at high doses the main effect of a toxic metal may overwhelm any interaction. Aims: We examined additive and multiplicative effects of prenatal mixed metal exposures on early childhood neurodevelopment in a cohort of mother-infant pairs living proximal to an EPA-designated Superfund Site contaminated with metals. Methods: We collected maternal blood samples at delivery and measured arsenic, manganese, and lead concentrations using ICP-MS. We assessed mental (MDI) and motor (PDI) development in 300 children at 12 and/or 24 months of age using Bayley Scales of Infant Development-II. We modeled associations of neurodevelopment with a) metals exposure allowing for interactions between metals, and b) a categorical measure of multiple metal exposure, where an indicator variable was used to represent the number of metals at or above median levels. Results: Median levels for lead, manganese, and arsenic, respectively, were 0.58, 2.33, and 0.16 µg/dl. In multivariable regression models including adjustment for lead and arsenic, we observed a significant inverse association between blood manganese levels (µg/dl) and 24-month MDI (β = -0.15 [95% CI: -0.26 to -0.03]. MDI and PDI scores at 24 months were also significantly lower when maternal blood levels were at or above the median for 2 or 3 metals, compared to when blood levels were at or above the median for 0 or 1 metal (for MDI: β = -0.34 [-0.59 to -0.08]). No significant multiplicative interactions were observed. Conclusions: This is among the first studies to report adverse effects of prenatal manganese exposure on childhood cognition, while adjusting for co-exposures. Our finding of lower neurodevelopment scores among subjects with a higher body burden of multiple metals, even in a low-exposure setting such as this, highlights the need to understand joint exposures.

Abstract Number	**O-4-15-03**
Presenter	Xiaodan Yu*
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cohort study

Se protects neonates against neurotoxicity from prenatal Mn exposure

Background: Manganese (Mn) exposure can interfere with development of brain. Whether prenatal Selenium (Se) levels can protect neonates against neurotoxicity from Mn exposure remains unclear. Methods: We investigated these questions in 933 mother-newborn pairs in Shanghai, China, from 2008 through 2009. Umbilical cord serum concentrations of Mn and Se were measured and Neonatal Behavioral Neurological Assessments (NBNA) tests were conducted. The NBNA contains five clusters: behavior, active tone, passive tone, primary reflexes and general assessment with a maximal total score of 40. The score<37 is defined as low. Results: The median cord serum Mn and Se concentrations was 4.0µg/L and 63.1µg/L, respectively. A higher level of Mn (≥75th percentile) was associated with a lower NBNA score (adjusted ß=-1.2, 95% CI: -1.4 to -1.0, p<0.001) and a higher risk of low NBNA (adjusted OR = 8.0, 95% CI: 2.8 to 23.0, p<0.001). After adjsting for potential confounders, the interaction between Se and Mn was observed. Cord blood Mn exposure had different effects on NBNA score stratified by different cord blood Se levels. When Se< P50 (<63.1µg/L), Mn was negatively associated with NBNA score (adjusted ß=-1.1, 95% CI:-1.3 to -o.8, p<0.001) and a higher risk of low NBNA (adjusted OR = 5.6, 95% CI: 2.8 to 11.2, p<0.001); While the adverse effect was disappeared when Se≥P50 (≥ 63.1µg/L) (NBNA: adjusted ß=0.1, 95% CI:-0.3 to 0.5, p=0.666; Low NBNA: adjusted OR = 4.5, 95% CI: 0.42, to 46.7, P=0.213). In addition, high Mn exposure population with low Se level [Mn≥ P75 (9.1µg/L) and Se <P50 (63.1µg/L)] had much lower NBNA score (38.0±1.6 & 39.5±0.9) than that of high Mn exposure population with high Se level [Mn≥ P75 (9.1µg/L) and Se≥P50 (63.1µg/L)] (P<0.001).Conclusions: High prenatal Mn exposure at environmental relevant level is associated with poor fetal neurobehavioral development. Se has protective effect against neurotoxicity from prenatal Mn exposure.

Abstract Number	**O-4-15-04**
Presenter	Philippe Grandjean*, Jordi Julvez, Sue Ring, George Davey-Smith
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Genetic predisposition to mercury-associated cognitive deficit at age 8 years in the ALSPAC cohort

Background: Developmental neurotoxicity due to prenatal methylmercury exposure seems to vary between populations and may be related to genetic predisposition. Aims: To assess IQ at school age in regard to prenatal methylmercury exposure, while taking into regard relevant genetic polymorphisms. Methods: Stored cord tissue from 1311 subjects of the Avon Longitudinal Study of Parents And Children (Bristol, UK) was freeze-dried and analyzed for mercury as measure of prenatal methylmercury exposure. Within this group, 1135 children had available information on 247 single-nucleotide polymorphisms (SNPs) in relevant genes, as well as the Wechsler Intelligence Scale for Children Intelligence Quotient (IQ) scores at age 8 years. Multivariate regression models were used to assess the associations between methylmercury exposure and IQ and to determine possible gene-environment interactions. Results: Mercury concentrations indicated low background exposures (mean (standard deviation) in ng/g: 26 (13)). IQ and log-10 transformed mercury conentrations showed positive associations, which attenuated after adjustment for nutritional and socio-demographic cofactors. Among 40 SNPs showing nominally significant main effects, methylmercury interactions were detected for rs662 (Paraoxonase 1) and rs1042838 (Progesterone Receptor) ($p < 0.05$) and for rs3811647 (Transferrin) and rs2049046 (Brain-Derived Neurotrophic Factor) ($p < 0.10$). The strongest negative associations between mercury and IQ were seen in the 175 subjects with at least four mutations in these genes. Conclusions: In this population with a fairly low level of methylmercury exposure, only equivocal associations between methylmercury exposure and adverse neuropsychological outcomes were observed. However, heterogeneities in relevant genes suggested possible genetic predisposition to methylmercury neurotoxicity in a substantial proportion of the population.

Abstract Number	**O-4-15-05**
Presenter	Linda Valeri*, Brent A. Coull, Birgit Claus Henn, Molly Kile, Omar Sharif Ibn Hasan, Golam Mostofa, Quazi Quamruzzaman, David C. Christiani, David C. Bellinger, Robert Wright, Maitreyi Mazumdar
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

METAL MIXTURES EXPOSURE AND CHILD NEURODEVELOPMENT: EVIDENCE FROM RURAL BANGLADESH

Background: Arsenic, manganese and lead exposure are common in Bangladesh. These metals can cross the placenta and are neurotoxic. Limited epidemiologic data currently exists on interactive effects of metal mixtures on child neurocognitive outcomes. Aims: We examined whether exposure to mixtures of arsenic, lead and manganese are associated with neurocognitive outcomes and whether there is evidence of interaction among metals. Methods: Umbilical cord blood samples were collected at delivery from 781 infants in Bangladesh. Whole blood arsenic, lead, and manganese were measured using ICP-MS. Bayley scale of infant development Third Edition (BSID-III) scores were measured at approximately 24 months of age. Associations of cognitive and motor composite scores with lead and manganese concentrations on the logarithmic scale, and arsenic categorized in tertiles, were modeled allowing for quadratic effect of ln-manganese and for interactions between metals. Results: Mean (SD) cord blood levels for arsenic, lead, and manganese were 0.951 (1.905) µg/dl, 6.176 (6.75) µg/dl, and 12.575 (15.75) µg/dl, respectively. In adjusted multivariable regression models, lead, the second tertile of arsenic, and manganese were inversely associated with 24-month motor composite score (β=-0.71, p-val=0.01; β=-2.13, p-val=0.01; β=-1.25 , p-val=0.061, respectively). There was evidence of lead-arsenic interaction. Lead toxicity was increased among children in third tertile of arsenic exposure, compared to children in first tertile of arsenic (β= -0.33, p-val=0.006). Further, using splines to explore non-linear effects we detected an inverted-U relationship between manganese and motor score at the second arsenic tertile (p-val=0.0003). Conclusions: Bangladeshi children have high exposure levels to arsenic, lead and manganese. We found evidence of interactions among these metal exposures, suggesting that joint exposure is synergistic. The interactions were non linear and would have been missed using main effects regression models.

Abstract Number	**O-4-15-06**
Presenter	M. Patricia Fabian*, Susan A. Korrick, Junenette Peters, Jonathan Levy
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cohort study

Risks from chemical and non-chemical stressors associated with attention deficit hyperactivity disorder (ADHD)-like behavior using structural equation models

Background. ADHD-like behavior – assessed using psychometric tests and behavioral rating scales – is associated with multiple chemical and non-chemical stressors, including sociodemographic characteristics and exposure to heavy metals and organochlorines. However, the effect of combined exposures has not been evaluated. Aim. To determine the interactions between a priori risk factors of ADHD-like behavior using structural equation modeling (SEM), in a framework which informs cumulative risk assessment. Methods. Using data from an established birth cohort in the low-income urban community of New Bedford, Massachusetts, we developed models predicting exposures to risk factors associated with ADHD-like behaviors, using individual level data from the cohort and geospatial and demographic information from public databases. Models were built for postnatal chemical exposure (e.g. lead (Pb)), prenatal chemical exposures (e.g., Pb, organochlorines (PCBs, DDE), and mercury (Hg)) and non-chemical exposures (e.g., stress). ADHD-like behavior was evaluated using the Connors' Teacher rating scales, and SEMs were applied to model the relationship between predictors of exposure, exposures, and ADHD-like behavior. Results. Common predictors of prenatal biomarker measures of Pb, PCB, DDE and Hg included mother's date of birth, country of birth, and household income. Food consumption patterns (e.g. fish and organ meat) were associated with prenatal exposure to DDE, PCB and Hg, while home attributes (e.g. construction year and assessed value) were associated with postnatal blood Pb concentrations. SEMs illustrated that sociodemographic characteristics both acted as predictors of exposures and had direct associations with ADHD-like behavior. Conclusions. We developed a structural equation model of environmental risk factors for ADHD-like behavior which integrates chemical and non-chemical stressors. The model will inform a community wide cumulative risk assessment model.

Abstract Number	**O-4-16-01**
Presenter	Ricardo Luis Teles de Carvalho*, Ole Michael Jensen, Luis Antonio da Cruz Tarelho, Adeildo Cabral da Silva
Exposure	household air pollution
Health domains	respiratory disease
Type of research	review

Scaling housing interventions for wood-burning stoves worldwide

The wood-burning stove is the most popular energy technology in the world since about 3 billion people rely on it for both domestic cooking and heating purposes. It is estimated that in 2030 more than 200 million people will be affected by this abundant energy source. Large-scale clean stove programs have been being implemented worldwide, but still there is a lack of innovations targeting its efficient carbon retrofitting into the built environment. This research aims to catalog the most common wood-burning stove designs used in both developed and developing countries, scaling the existent levels of complexity concerning stove integration in distinct building envelopes. A representative calculation of the environmental performance of improved stoves was carried out in order to compare the carbon reduction potential in developing and developed regions, considering representative conditions in single families of south-America and Europe, based on the heat demands, consumption and the carbon emissions for both scenarios of user's best and usual practices in the domestic wood combustion. In South-America, the recent implementation of a new low cost efficient masonry stove saves in about 40% the energy consumption under the best operating practices in traditional households. However, under the daily use of stoves considerable amount of carbon emissions were identified. In Nordic countries, a new expensive cast iron stove (from 2012) reduces in 50% the biomass consumption through the automatic control of wood combustion in efficient houses. In both cases, carbon emissions can be reduced by lowering or improving the interaction of the users with the stove combustion chamber. This calculation model will be able to show what technology upgrades can be performed to reduce the global carbon emissions in households not only in developed but also in developing countries where there is the major potential to reduce the buildings carbon footprint by improving indoor climate.

Abstract Number	**O-4-16-02**
Presenter	Alfred Lawrence*, Nishat Fatima
Exposure	household air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Indoor Air Pollution Due to Fireworks during Diwali Festival and its Human Health Effects in Lucknow, India

Extensive use of firecrackers during the mega festival of light Diwali, in India is found to be related to short term variation in air quality. In this study, PM10, PM2.5, CO2, CO, H2S, SO2, NO2 and 10 trace metals associated with PM2.5 were estimated at different locations in Lucknow for Pre and post Diwali. A control day monitoring was also done to obtain the control concentrations of the air pollutants. Monitoring was done in indoor air for 24 hours to measure the effect of Diwali episode. The instrument employed for PM10 and PM2.5 was APM550; for CO, CO2, H2S was YES205 and 206; SO2 and NO2 by impinger method (spectrophotometer method). The average concentration of PM10 and PM2.5 on the day of Diwali were 863.3 and 660 µg/m3 respectively which were 4.42 times higher than the concentration on control day. Concentration of pollutants on Post-Diwali day was observed to be higher than the pre Diwali day which indicate a longer time stay of these pollutants in Indoor air accumulated on Diwali night due to fireworks. On the day of Diwali concentration of pollutants were in order of PM10 (188.51%) > PM2.5 (147.51%) > SO2 (125.69%) > NO2 (79.12%) to Pre Diwali day and showed significantly higher (PM10 & SO2 at $p<0.01$ and NO2 for $p<0.05$ level) and PM10 (527.51%) > SO2 (459.37%) > NO2 (229.11%) to normal day and all the values showed significantly higher ($p<0.01$). The average concentration of metals associated with PM2.5 on Diwali Day was found to be in the order of Ca(2,876.41) > Fe(879.09) > Zn(476.2) > Cu(412.6) > Pb(287.61) > Mn (76.54) > Co(69.87) > Cr(37.81) > Ni(33.2) > Cd(27.82) in ng m−3 and all these values were found to be higher than the Pre Diwali and control. In order to estimate the health impact of short-term degradation of air quality during Diwali, percentage increase in relative risk of mortality and morbidity due to short-term exposure to increased level of air pollutant concentrations was used as the evaluating parameter.

Abstract Number	**O-4-16-03**
Presenter	Hiroko Nakaoka*, Emiko Todaka, Hiroshi Seto, Ikue Saito, Masamichi Hanazato, Masahiro Watanabe, Chisato Mori
Exposure	household air pollution
Health domains	other
Type of research	others

Correlation of symptoms of sick-building syndrome to chemical and odor concentration levels

[Background] Sick-building syndrome (SBS) is a range of symptoms such as eye irritation, sore throat and headaches that occur when entering a newly constructed or remodelled building.Volatile organic compounds (VOCs) are suspected to be one of the major causes of SBS. In addition, there are reports that when people complain of symptoms of SBS, most of them also claim to smell an odour. [Aims] The aims of this study were (1) to quantify the odour in indoor air, (2) to examine the correlation between the concentration levels of total VOCs (TVOC) and SBS symptoms, and (3) to examine the correlation between odour and SBS symptoms. [Methods] The concentration levels of chemicals in indoor air of the 13 study sites in Chiba University were measured and analyzed.The odour threshold ratio (OTR) was developed to quantify odour by using odour threshold and concentration values for each VOC in indoor air.Next, for the evaluation of indoor air quality by human sensory perception, 218 healthy volunteers stayed for 15 minutes at the 13 study sites and answered questionnaires which inquired about the odour and symptoms. Then correlations of SBS symptoms to TVOC andtotal odour threshold ratio (TOTR) values were examinedstatistically among sensitive and insensitive groups. [Results] There were 218 subjects,of which 134 were female and 84 were male. 35.8% of females and 34.5% of males were classified as being sensitive to chemicals. The percentage of participants who complained of symptoms was 36.7%. It was found that TVOC and TOTR values were significantly correlated with SBS symptoms, especially among the sensitive group when the concentration level of TVOCs was greater than about 400 µg/m3 (95%CI 1.06-14.33) and the level of TOTR was greater than about 40 (95%CI 1.03-20.35). [Conclusion] This study revealed the baseline level of TVOC that may cause SBS symptoms to be about 400 µg/m3and a TOTR value of about 40.It also suggests that TOTR could be used asa new indicator forevaluating the effects ofindoor air quality on human health.

Abstract Number	**O-4-16-04**
Presenter	Célina Roda*, Ioannis Nicolis, Chantal Guihenneuc-Jouyaux, Isabelle Momas
Exposure	household air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Performances of Several Approaches Handling Large Amounts of Missing Data in Environmental Epidemiological Studies

Background Missing data are unavoidable in epidemiological studies. The proportion of missingness can be high, especially in environmental epidemiological studies where measurements are generally carried out in subsamples due to the resources needed for samplings and analysis. Aim To compare performances of several methods for handling missing values: omission of missing values, single and multiple imputations, and the hierarchical Bayesian approach which simulates the distributions of variables with missing data as well as unknown parameters in a regression model. Methods These methods were applied to the PARIS (Pollution and Asthma Risk: an Infant Study) birth cohort, where domestic pollutant measurements were performed in a random sample of 5% babies' dwellings. A simulation study based upon simulated data with characteristics close to those of real data was performed. Different simulation scenarios were carried out, controlling the true value of the association (odds ratio of 1.0, 1.2 and 1.4), varying the number of missing values (none, 50% and 95%), and the health outcome prevalence. Results When a large amount of data are missing, omitting these missing data reduced statistical power and inflated standard errors, which affected the significance of the association. Single imputation underestimated the variability, and considerably increased type I risk. Multiple and Bayesian imputation showed the least biased estimates. All approaches were conservative, except the Bayesian approach. In the case of a common health outcome (46%), the Bayesian approach seems to be the most efficient approach (low bias, and high statistical power: 75%). Nevertheless for a less common event, performances of the Bayesian approach were reduced, and risk of type I is overestimated (16%). Conclusion Among the methods handling missing values, no approach is absolutely better than an other in all circumstances. Further studies are needed to give guidelines on how to handle huge missing values.

Abstract Number	**O-4-16-05**
Presenter	Hyunok Choi*, Samuel Byrne, Norbert Schmidbauer, John D. Spengler, Carl-Gustaf Bornehag
Exposure	household air pollution
Health domains	allergies
Type of research	case-control study

Dampness-Related Indoor Chemical Mixture and Allergic Disease Risk

Background: It remains unclear whether dampness-related chemicals (DRC) within the home indoor environment pose independent risks on asthma, rhinitis, eczema, and multiple allergy symptoms in children. Objective: We examined whether: 1) the DRC as a unique group is correlated with microbial-, human behavioral- or building structural sources; 2) the DRC concentration pose an independent risk on above outcomes; 3) the DRC modify the risks of propylene glycol and glycol ethers (PGEs) on the same outcomes. Methods: In a case-control investigation (198 cases with asthma and allergy and 202 healthy controls), air and dust samples were collected in the room where the child slept. The air samples were analyzed for the volatile organic compounds. The dust samples were analyzed for six phthalates (mg/g dust), including benzyl butyl phthalate (BBzP), and total viable mould concentration. In addition, we grouped individual DRCs and PGEs into a common group, based on principal component analysis. Results: Individual DRC compounds were significantly correlated with PGEs emitted from the indoor paint (in particular, Texanol B™), polyvinyl material, water-based cleaning, and indoor conditions (i.e., absolute humidity and ventilation). Individual DRC compound levels were overall higher in the homes of the cases, compared to those in the control homes. When a DRC compound (i.e., 2-ethyl-1-hexanol) were included in the definition of PGEs, the unit PGE risks on the multiple allergic symptom (aOR=2.3, 95% CI, 1.4-3.8), and the respective diagnosis of asthma (aOR=2.7, 95% CI, 1.4-4.9), rhinitis (aOR=4.3, 95% CI, 2.0-8.9), and eczema (aOR=2.4, 95% CI, 1.4-4.3) were significantly greater than our earlier reported effect sizes. Conclusion: The DRCs are common correlates of indoor humidity. Here, 2-ethyl-1-hexanol, grouped together with PGEs, based on source profile, pose significantly greater risk on the case status, and the respective diagnosis of asthma, rhinitis, and eczema than our prior estimations that solely considered PGEs.

Abstract Number	**O-4-16-06**
Presenter	Tomas Tamulis*, Dmitry Krupitsky
Exposure	household air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Community-based Participatory Research Intervention to Reduce the Exposure to Environmental Asthma Triggers and Severity of Asthma among Asthmatic Children in H

Background The long-term partnership between state health agencies, local community health centers, and the community is essential to ensure the success of community-based participatory research interventions. The main goal of the community-based intervention was to reduce the severity and frequency of daily asthma symptoms, and to improve the overall quality of life for children with asthma by reducing the exposure to in-home environmental triggers, and by increasing the knowledge about individual asthma action plan, and self-management of asthma. Methods The Childhood Rural Asthma Project was coordinated by Hawaii State Asthma Control Program, in collaboration with Hawaii Primary Care Association, Waianae Coast Comprehensive, West Hawaii Community, and Ko`olauloa Community Health Centers. The study area covered the administrative districts of Kona, Big Island county; and Koolauloa, and Waianae, Honolulu county, in Hawaii. 86 children with physician-diagnosed asthma (ICD-9: 493.00-493.99) were enrolled in the project during 2010-2011. The intervention included the delivery of standardized educational program, development of individual asthma action plan, and the distribution of environmental toolkit items to reduce the exposure to indoor environmental triggers of asthma. The Logic evaluation model was used to conduct the pre- and post-assessment of selected program performance and outcome indicators. Results and Conclusions The project results indicated that such environmental triggers as: seasonal changes, absence of AC, ambient air pollution, second hand smoking, and the presence of cockroaches at home were risk factors of more frequent and severe asthma symptoms. The absence of or limited knowledge on asthma control and self-management was indicated by the majority of participants. The number of daily asthma symptoms, missed school days, and physician visits was significantly reduced among study participants. Finally, the intervention proved to be effective in improving disease self-management, and overall quality of life of children with asthma.

Abstract Number	**O-4-17-01**
Presenter	Oscar Breugelmans*, Danny Houthuijs, Wim Swart, Klaasjan Hajema, Roel Hogenhuis, Ric van Poll
Exposure	noise
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Aircraft noise and health: is Lden the proper indicator to describe the relationship?

Background Possible health effects of noise, such as annoyance, sleep disturbance and cardiovascular diseases are related to the yearly averaged noise metric Lden. It is suggested that the Lden underestimates the effects of high sound exposure levels (SEL) of infrequent noise events. The Lden assumes a trade-off between the number of overflights and the SEL of the events based on the equal energy principle; a 10 dB decrease in the SEL in combination with an increase of the frequency with a factor 10 will result in the same Lden. Aims Study the impact of a varying trade-off factor on the relation between the yearly averaged noise level and perceived health to assess if more weight in the Lden should be given to the number of overflights or to the SEL. Methods Data was collected with a general health questionnaire in a Dutch population near a NATO military aircraft base with different flight patterns and type of aircrafts. Based on the distribution of SEL values, a range of Lden's using different trade-off factors were calculated and related to a range of health effects. Results 9,386 respondents filled out the questionnaire. The aircraft noise levels of postal codes ranged from 29 to 54 dB Lden and the percentage of severe annoyance varied from 1 to 72%. The number of aircraft movements was over 2,800 per year. Logistic regressions of the annoyance-noise relation indicate an improved model fit when trade-off factors are used emphasizing SEL over the number of overflights. A decrease of 10 dB in SEL could lead to an increase in frequency with a factor of 12.5 instead of 10. Conclusions Policy decisions about airport enlargements or improvements balance economic considerations with the negative environmental impact on residents. The role of the trade-off between the number of overflights and the SEL of the events appears to be under-estimated in this

Abstract Number	**O-4-17-02**
Presenter	Charlotta Eriksson*, Agneta Hilding, Andrei Pyko, Gösta Bluhm, Göran Pershagen, Claes-Göran Östenson
Exposure	noise
Health domains	obesity
Type of research	cohort study

Aircraft noise and metabolic outcomes

Background: Long-term aircraft noise exposure may increase the risk of cardiovascular disease, but no study has investigated chronic effects on the metabolic system. Aims: The aim of this study was to assess the associations between long-term aircraft noise exposure and body mass index (BMI), waist circumference and Type 2 diabetes. Furthermore, we aimed to explore the modifying effects of sleep disturbance. Methods: In this prospective cohort study, we followed 5 411 Swedish men and women living in five municipalities in Stockholm County for up to ten years between 1992 and 2006. Time-weighted average aircraft noise exposure around Stockholm Arlanda airport was estimated during the follow-up period based on residential history. Baseline and follow-up surveys, including questionnaires and clinical examinations, provided information on outcomes and confounders. Subjects with prediabetes or Type 2 diabetes were identified by an oral glucose tolerance test. We used linear and logistic regression models to assess statistical associations and adjusted the results for individual as well as area-based confounders. Results: Mean increase in BMI between baseline and follow-up was 1.10 kg/m2 (SD 1.99) and for waist circumference 4.40 cm (SD 6.45). In total, we identified 434 cases of prediabetes and 172 cases of Type 2 diabetes, corresponding to cumulative incidences of 8 % and 3 %, respectively. In the fully adjusted model, we found a statistically significant association between aircraft noise and change in waist circumference, with a 1.24 cm (95 % CI 0.62 to 1.85) increase per 5 dB(A) rise. No clear associations were found for BMI or Type 2 diabetes, although the risk for diabetes tended to be elevated among women; OR=1.60 (95 % CI 0.94 to 2.70) per 5 dB(A) rise. Sleep disturbances did not appear to modify the association with aircraft noise. Conclusions: Long-term aircraft noise exposure may be linked to metabolic outcomes, in particular change in waist circumference.

Abstract Number	**O-4-17-03**
Presenter	Mikael Ögren*, Lars Barregård, Peter Molnar
Exposure	noise
Health domains	policy
Type of research	exposure modeling

Noise Exposure in Gothenburg from 1975 to 2010

Background & aims The exposure to noise for the inhabitants of a city changes over time, and the two most important factors are the traffic flow and urbanization.This study is aimed at showing how the exposure has changed in the city of Gothenburg (Sweden) from 1975 to 2010. Methods The traffic flows were estimated using traffic measurements distributed over the city, and the population was obtained in each 100 meter square over the city for every five years of the period. Using the standardized Nordic calculation methods for road traffic noise the noise level was estimated across each square with the population evenly distributed over the square. The noise emission changes of the vehicle fleet was also estimated over the period from measurements, and the major noise barriers were included from the time they were constructed. Results & conclusions The results show that the number of people exposed to equivalent noise levels above 55 dB has increased by about 50 percent during the period, and that urbanization and increasing traffic flows are approximately equally important explanations for the increased exposure.

Abstract Number	**O-4-17-04**
Presenter	Vilija Malinauskiene*, Abdonas Tamosiunas
Exposure	noise
Health domains	cardiovascular disease
Type of research	case-control study

Joint effects of road-traffic and occupational noise and low job control on myocardial infarction risk among women

Background. Some investigations confirm joint effects of environmental and psychosocial exposures on myocardial infarction risk. The aim of the present study was to assess joint effect of road-traffic and occupational noise exposure and low job control and first myocardial infarction risk among 35-62 year old women. Methods. We conducted a population based case-control study on first time myocardial infarction among able-bodied women in Kaunas, Lithuania in 2001-2004. Totally 122 myocardial infarction cases and 371 controls were interviewed. Residential road-trafficnoise exposure was based on residential history combined with information on traffic intensity and distance to nearby roads. Occupational noise exposure was assessed by occupational history combined with a job-exposure matrix derived from measurements. Psychosocial job characteristics were assessed by Job Content Questionnaire (Karasek R.and Theorell T.). Logistic regression analysis was performed. Results. After adjustment for sociodemographic, behavioral, physiological factors the Odds ratio for residential traffic noise exposure was 1.17; 95% CI 0.94-3.50, for occupational noise exposure OR=1.08; 95% CI 0.89-3.60, for low job control 1.94; 95% CI 1.56-4.60. In the fully adjusted model the joint effect of those three exposure was shown with OR=2.61; 95%CI 1.56-5.61. Conclusions. Our results indicated that exposure to a combination of residential and occupational noise and low job control increased the risk of the first myocardial infarction substantially. Preventive measure should be directed to confront noise exposure and organizational climate at work.

Abstract Number	**O-4-17-05**
Presenter	Dorothee Twardella*, Carmelo Perez-Alvarez, Thomas Steffens, Angelika Zirngibl, Gabriele Bolte, Hermann Fromme, Ulla Raab
Exposure	noise
Health domains	other
Type of research	cross-sectional study

The prevalence of noise-induced hearing threshold shifts in adolescents: The Ohrkan-study

Background: While noise exposure at the workplace is regulated to minimize the risk of hearing loss, leisure noise exposure is likely to pose a risk for hearing as well. However, valid recent data on hearing loss prevalence in the population mostly affected by leisure noise exposure, i.e. adolescents and young adults, are rare. Aims: To estimate the prevalence of noise induced hearing loss in adolescents. Methods: Within the cohort study Ohrkan a baseline assessment of hearing levels was conducted in students grade nine (usually 15 or 16 years old) visiting any school in the city of Regensburg. Students were recruited during the school years 2009/2010 and 2010/2011. Socioeconomic data were collected via standardized questionnaires. Examinations were conducted at the University Hospital Regensburg and included a tympanogram and pure tone audiometry. Among students with normal tympanogram in both ears, subjects with a notched audiogram according to Niskar et al. 2001 were classified as showing a hearing loss potentially caused by noise exposure (NITS). The Ohrkan study was funded by the Bavarian Ministry for the Environment and Health. Results: Overall, 2,149 students (1,158 girls, 991 boys) of the 3,846 eligible students (56%) participated. Among the 1,843 students with normal tympanogram, the prevalence of NITS was 2.4% (95% confidence interval 1.7% to 3.1%). Conclusions: The high prevalence of noise-induced hearing loss in adolescents as reported from other studies could not be confirmed. However, high leisure noise exposure might cause new cases in the forthcoming years. Future follow-up will reveal changes in hearing status and will allow the prospective identification of risk factors for hearing loss.

Abstract Number	**O-4-17-06**
Presenter	Carla Ancona*, Francesca Mataloni, Sera Study Team
Exposure	noise
Health domains	cardiovascular disease
Type of research	health impact assessment

The impact of aircraft noise on the health of population living near six Italian airports

Background: Aircraft noise has been associated with several health effects. Because of the great success of low cost flights, small airports have been turned into international airports thus exposing nearby residents to an increase in noise levels and potential disturbances and health disorders. Objective: to estimate the exposure levels and evaluate the health impact of aircraft noise on residents nearby six airports in Italy (Rome-Ciampino; Milan- Linate and Malpensa; Pisa, Turin, Venice) focusing on hypertension, annoyance, and high sleep disturbance (HSD). Methods: residents in the local municipalities at 31/12/2010 were enrolled in the study and their addresses were geocoded.Aircraft noise exposure in 2010 were defined using the Integrated Noise Model linked to each participant's address. Lden (<55, 55-59, 60-64, 65-70, 70-75 dB), Lnight, Leq (day and night) were calculated. We used previously developed concentration-response functions (Methodological guidance for estimating the burden of disease from environmental noise WHO 2012) to estimate the number of attributable cases of hypertension, annoyance and HSD in the local population. For hypertension we considered only residents aged 40+. Results: 687.147 persons were recruited, 125.621 (18.3%) of whom exposed to aircraft noise levels >55dB. There were 101.528 (14.8%) subjects exposed to 55-60 dB, 22.016 (3.2%) to 60-65 dB, 1.890 (0.28%) to 65-70 dB, and 188 (0.03%) to 70-75 dB. We estimated that exposure to aircraft noise levels above 55 dB were responsible each year of 1.577 (1.25%) additional cases of hypertension, 11.572 (9.21%) additional case of annoyance, and 10.101 (8.04%) additonal cases of HSD. Conclusions: Low cost flights are certainly good for travellers but the effects of aircraft noise on residents near airports are far from negligible. The Italian SERA study is providing indications on potential health effects from aircraft noise.

Abstract Number	**O-4-18-01**
Presenter	Toshihide Tsuda*, Eiji Yamamoto, Etsuji Suzuki
Exposure	ionizing radiation
Health domains	cancer
Type of research	others

Thyroid Cancer under 19 years old in Fukushima, Japan

Background: Fukushima Daiichi Nuclear Power Plant began to release radioactive substance after the earthquake on March 11, 2011, which included radioactive iodine and cesium. Therefore, incidence of thyroid cancer among childhood in the area has been a public health concern. The committee of health control examination in Fukushima Prefecture planned thyroid cancer screening for all children aged 18 years or younger every 3 years. The results of the screening have been released every 3 months. The screening was undergone at the nearest areas from the power plant in the first year (until March 31th, 2012), then at the moderately near area including Fukushima City in the second year (until March 31th, 2013). We present our findings based on the data until June 5th, 2013. Aim: To estimate childhood thyroid cancer incidence rate ratio in Fukushima, compared with age, sex-specific incidence estimates of thyroid cancer (1975-2008) from the Center for Cancer Control and Information Services, National Cancer Center, Japan. Poisson distribution was employed to estimate 95% confidence intervals. Results: From the nearest area group (mostly within 50km from the power plant: 40,764 examinees), 205 cases were suspected by ultrasound imaging, 166 (81.0%) were undergone on the 2nd examination, then, 11 thyroid cancer cases were identified by cytology, of which 7 cases have been operated and confirmed. Mean age of the cancer cases in the nearest area was 17.3 (range 13-19) years old, and mean diameter 14.1 mm (range 6.0-33.0mm). From 46,367 examinees of Fukushima City (50-80 km from the power plant), 263 cases were suspected by ultrasound imaging, 228 (86.7%) were undergone on the 2nd examination, then, 9 thyroid cancer cases were identified by cytology. Assuming two years for duration on detectable level of cytology until clinical level, incidence rate ratio was 26.98 (95% confidence interval, 14.12-48.61) in the nearest area, and in Fukushima city, it was 19.41 (95% confidence interval, 9.62-37.31), compared with the Japanese mean annual incidence among those aged 15-19 years from 1975 to 2008 (i.e., 5 per 1,000,000). Conclusions: Although any screening effect may exist, excess incidence rate ratios were observed in both the nearest area and Fukushima City. Dose-response relationship by distance from the plant was indicated. Both further investigations and countermeasures against the suspected outbreak are necessary in Fukushima and the neighboring areas.

Abstract Number	**O-4-18-02**
Presenter	Rakesh Ghosh*, Jan Topinka, Jesse Joad, Mirek Dostal, Radim Sram, Irva Hertz-Picciotto
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Gene-environment interaction and acute childhood bronchitis

Gene-environment interaction studies have often focused on chronic diseases in children such as asthma. This study, for the first time, investigates the relationships of second-hand tobacco smoke (SHS), polycyclic aromatic hydrocarbons (PAH) and PM2.5, with physician diagnosed acute bronchitis in the first two years, stratified by genotypes. In the Czech Republic 1133 randomly selected children, born between 1994 and 1998, was followed-up prospectively from birth, of these 793 were genotyped. Pediatric records were abstracted for acute bronchitis episodes. Information on several confounders including SHS exposure (y/n) was obtained through questionnaires and urinary cotinine verified the latter. Air monitoring provided ambient PAH and PM2.5 data. DNA was extracted from mid placental tissues, opposite the umbilical cord. We examined six single nucleotide polymorphisms (GSTM1, GSTP1, GSTT1, CYP1A1 MspI, EPHX1 exon 3 and 4) and one diplotype (combining EPHX1 exon 3 and 4). To investigate effect-measure modification we constructed logistic models using generalized estimating equations (for repeated observations), stratified by genotypes. Owing to the daily follow-up we had about 550,000 observations, which permitted us to perform gene-gene-environment analyses. The genotype sub-sample resembled the follow-up sample with respect to baseline characteristics, assuring no selection bias. Also, genotype prevalences were comparable to Caucasian populations. Bronchitis incidence was 55.3 per 1000 child-months. Children with histidine alleles at EPHX1 exon 4 had a significantly higher association for SHS, OR=1.62 (95% CI: 1.20, 2.19) while for PAH and PM2.5 it was higher at exon 3, OR=2.05 (95% CI: 1.25, 3.36) and 2.42 (95% CI: 1.61, 3.65), respectively. The EPHX1 low activity diplotype had consistently higher association across all three exposures, for SHS it was 1.92 (95% CI: 1.25, 2.95), while for PAH/PM2.5 the OR was in the order of 1.5. In gene-gene-environment analysis, children with both low activity EPHX1 diplotype and CYP1A1 MspI genotype had higher association for PAH [2.43(95% CI: 1.23, 4.77)] and PM2.5 [2.52(95% CI: 1.30, 4.90)]. Children with EPHX1 diplotype and GSTT1 null genotype had substantially high OR for SHS [3.65(95% CI: 1.39, 9.62]. Several xenobiotic metabolizing genes modify the associations between three classes of pollutants and acute bronchitis with consistent results for EPHX1 gene with histidine alleles.

Abstract Number	**O-4-18-03**
Presenter	Ben D Spycher*, Martin Feller, Roland A. Ammann, Manuel Diezi, Martin Röösli, Matthias Egger, Claudia E. Kuehni
Exposure	ambient air pollution
Health domains	cancer
Type of research	cohort study

Childhood cancer and exposure to heavily trafficked roads: a nationwide cohort study

Background Benzene is a recognised carcinogen and an important component of traffic-related air pollution. Previous research on the association between air pollution and childhood cancer was mostly based on case-control or ecological studies and produced inconsistent results. Aims To investigate, in a nationwide cohort study, whether children living close to heavily trafficked roads were at greater risk of developing cancer. Methods We used data from the Swiss National Cohort, which is based on the national censuses in 1990 and 2000 to calculate person-years at risk for the Swiss resident population aged <16 years over the period 1985-2009. Incident cases of cancer were identified from the Swiss Childhood Cancer Registry. Residential addresses at time of the census (resident population), and at time of birth and diagnosis (childhood cancer cases) were geo-coded. Using Poisson regression, we compared cancer incidence among children living in corridors of <100m, 100-250m, 250-500m around highways with those living >500m away. Results The study included 31.6 million person years and 4,410 cases of childhood cancer, of whom 1,373 (31%) had leukaemia and 896 (20%) had brain tumours. At diagnosis, 88 children with cancer (38 with leukaemia and 16 with brain tumours) lived <100m from a highway. Compared to children living >500m away, incidence rate ratios (IRRs) were 1.46 (95% CI 1.18-1.80), 0.88 (0.75-1.03), 1.02 (0.91-1.13) for all cancers in corridors <100m, 100-250m, 250-500m, respectively. For leukaemia and brain tumours in the <100m corridor, IRRs were 2.04 (1.48-2.82) and 1.32 (0.80-2.17), respectively. For leukaemia in children aged <5 years the IRR was 2.52 (1.67-3.78). Results were similar when using address at birth instead of diagnosis, and when adjusting for degree of urbanisation. Conclusions Our study suggests that the risk of cancer is substantially increased in children living in the immediate proximity of highways, particularly for leukaemia in <5 year olds.

Abstract Number	**O-4-18-04**
Presenter	Audrey Smargiassi*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Incidence of Asthma and Outdoor Ambient Air Pollutants: A Population-Based Birth Cohort Study

Asthma is the most common chronic disease in childhood in developed countries and there is large geographic variation in asthma incidence and prevalence. Few cohort studies have assessed associations between exposure to air pollutants and asthma onset and controversies have been noted. To our knowledge, no population based cohort study has been performed to address this issue. We constructed a population-based retrospective birth cohort in Quebec (Canada) using linked administrative health databases and precise children's residential location, to assess whether new cases of asthma in children are associated with residential exposure to ambient air pollutants. The open cohort started in 1996 and all newborns of Quebec were followed up until 12 years of age or March 2011. New asthma cases were identified through their lifetime use of medical services for asthma. The definition used for asthma case identification is based on at least two visits to a physician with a diagnosis of asthma over a two-year period, or one hospital discharge with a diagnosis of asthma. In Quebec all residents are beneficiaries of a universal health care delivery plan. Exposure at the residence of birth to summer ozone (O3) levels was estimated with a Bayesian Maximum Entropy model and to fine particulate levels (PM2.5), from MODIS satellite images. For a subgroup of children living on the island of Montreal, nitrogen dioxide (NO2) exposure was estimated with a Land Use Regression. Cox proportional hazards regressions (time 0 = birth) were used to assess risks of asthma onset with residential exposure at birth to ambient air pollutants. Models were adjusted with quintiles of the Pampalon deprivation index.There were 1 119 365 children who were born in Quebec from 1996 to 2011 and 157 102 developed asthma. Mean PM2.5 and summer O3 exposure levels were 9.74+ 3.45 µg/m3 and 32.07 + 2.56 ppb. For children of Montreal, mean NO2 levels were 15.25 + 3.74 ppb. Hazard ratios for PM2.5, O3 and NO2 were respectively 1.036 (1.034-1.037), 1.033 (1.031-1.036) and 1.010 (1.007-1.013) per one unit increase in exposure levels. Preliminary results suggest that early life exposure to ambient air pollutants is associated with the development of asthma in children. By following all children of Quebec, our population-based cohort study will allow us in future work, to assess how the inter-regional geographic variation of asthma incidence in children is influenced by exposure to air pollutants.

Abstract Number	**O-4-18-05**
Presenter	Reto Meier*, Wayne E. Cascio, Andrew Ghio, Pascal Wild, Brigitta Danuser, Michael Riediker
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	occupational study

Particle and noise exposure of highway maintenance workers: short-term effects on indicators of cardiovascular health

Particle and noise exposure of highway maintenance workers: short-term effects on indicators of cardiovascular health Background: Highway maintenance workers are constantly and simultaneously exposed to traffic-related particle and noise emissions, and both have been linked to increased cardiovascular morbidity and mortality in population-based epidemiology studies. Objectives: We aimed to investigate short-term effects related to particle and noise exposure on indicators of cardiovascular health. Methods: We monitored 18 maintenance workers, during as many as five 24-hour periods from a total of 50 observation days. We measured their exposure to fine particulate matter (PM2.5), ultrafine particles, noise and the cardiopulmonary health endpoints: blood pressure, pro-inflammatory and pro-thrombotic markers in the blood, lung function and fractional exhaled nitric oxide (FeNO) measured approximately 15 hours post-work. Heart rate variability was assessed during a sleep period approximately 10 hours post-work. Results: PM2.5 exposure was related to increased levels of C-reactive protein and serum amyloid A and to decreased tumor necrosis factor α. No effect was observed on von Willebrand and tissue factors. We observed an increase in heart rate variability in relation to PM2.5 and noise exposure during work. Increased high-frequency power indicated a stronger parasympathetic influence on the heart. Blood pressure increased as a consequence of elevated noise levels during recreational time after work and we saw a trend towards higher blood pressure in relation to PM2.5. We observed no effects on lung function and FeNO. Conclusions: Our data shows that exposure to particles and noise during highway maintenance work might pose a cardiovascular health risk. Actions to reduce these exposures could lead to better health for this population of workers. This presentation does not necessarily reflect US EPA policy.

Abstract Number	**O-4-18-06**
Presenter	Bertil Forsberg*, Nina Lind, Lars Modig, Maria Nordin, Steven Nordin, Anna Oudin, Lars-Göran Nilsson
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	cohort study

Vehicle exhaust level at home and incidence of diagnosed dementia

Background Vehicle exhaust has proven to be a risk factor for several chronic diseases. Recent years a few studies have suggested an association also between ambient air pollutants and mental decline. Aims We investigate traffic related air pollution and dementia diagnosis in a detailed longitudinal study, Betula, in Umeå, Sweden. Metods At the first data collection in Betula 1988-90, 1000 participants from ten age cohorts (35-80 yrs) were included. In the first 5-yr follow-up, 1993-95, two new samples were added; one with the same age distribution as the first sample had at inclusion, and one with persons born the same year as in the first sample. Information on deaths is matched from the cause of death register. The social variables of Betula include socio-economic variables, marital status, type of dwelling, living conditions, education, leisure activities, current daily activities, smoking, occupation, children, parents, childhood and adolescence, as well as availablity of friends. We used a high resolution land use regression model to calculate the annual mean vehicle exhaust level as nitrogen oxides (NOx) outside home. In 2756 participants we studied cumulative incidence of diagnosed dementia (261 cases) from 1993-1995 to follow up 2003-2005. Based on previous Betula findings, we adjusted for important predictors (age, sex, education) and risk factors (stroke, smoking, hypertension, diabetes, BMI, H/W ratio). Results The adjusted odds ratio for dementia associated with the 4th quartile vs the lowest quartile of vehicle exhaust (NOx) was 1.72 (95% CI 1.10 – 2.70). Also with NOx as a continuous variable a significant association was observed. Conclusions Our first analyses show a statistically significant and strong association between vehicle exhaust at home and dementia in a prospective cohort study. Ongoing analyses will investigate other endpoints, exposure lags and sensitivity to inclusion of other covariates.

Abstract Number	**O-4-19-02**
Presenter	Mutasem El-Fadel, Sophia Ghanimeh*, Rania Maroun
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Implications of Climate Change Induced Temperature Rise on Food and Waterborne Diseases and Heat-Related Mortality

Background Climate change affects human health in multiple ways, including exposure to thermal extremes and weather disasters, spread of vector- and rodent-borne diseases, emergence of new infectious diseases, pests and pathogens, food and water insecurity and deterioration of water quality. Aims This study attempts to quantify climate-induced increases in morbidity rates associated with food- and water-borne illnesses, as well as increase in premature mortality associated with temperature rise in the context of an urban coastal city, taking the Greater Beirut Area as a study area. Methods Climate projections, as forecasted by regional and global climate models, were used to predict the increase in daily temperature during the 21st century. A Poisson generalized linear model was then developed to quantify the relationship between climatic parameters and the number of reported food- and water-borne disease cases. As for the impact of heat on premature mortality, it was assessed using an empirical temperature-mortality model developed for Beirut city. Results The established correlation shows a decrease in the number of food and waterborne illnesses with increasing temperature until reaching a threshold of 19.2°C, beyond which the number of morbidity cases increases with temperature. By 2050, the results show a substantial increase in food- and water-borne related morbidity of 16 to 28% that can reach up to 42% by the end of the century under A1FI or can be reversed to ~0% under B1. In the case of heat-related mortality, during the first half of the 21st century, the expected life losses due to high temperatures in hot days are offset by expected life gains due to improved temperatures in cold days, except under the scenario that reflects intensive fossil fuel development. By year 2095, the annual average all-cause premature mortality is expected to increase by 3 to 15 %, depending on the scenario. This dependency of the results on the climatic scenario adopted highlights the need for early mitigation and adaptation measures.

Abstract Number	**O-4-19-03**
Presenter	Kavitha Palaniappan*, Santu Ghosh
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

The effect of climate variables on the risk of dengue incidence in Singapore: A temporal analysis for the period 2000-2012

THE EFFECT OF CLIMATE VARIABLES ON THE RISK OF DENGUE INCIDENCE IN SINGAPORE: A TEMPORAL ANALYSIS FOR THE PERIOD 2000-2012 Authors: Kavitha Palaniappan, Santu Ghosh Background: In spite of the multi-pronged dengue control strategy, the dengue epidemic remains a major public health concern in Singapore. The increased frequency of unusual weather conditions may favour the presence of Aedes mosquitoes. Hence there is a need to examine the relationship between climate variables and dengue risk so to assess the impact of the climate change on it in Singapore. Objective: This study examined the effect of seasonal factors and relationship between climate variables and dengue incidence per month in Singapore during 2000-2012 to identify the weather parameters that can predict the risk of the dengue epidemic. Methods: The weekly dengue incidence data were collected from the Ministry of Health Singapore's weekly epidemiological publications for the period 2000-2012 and were merged with the climate data reported by Changi Meteorological Station. Generalized Linear Model was used with Quasi-Poisson distribution to examine the association. Results: The best fitted model was the one with average monthly temperature, dew point and precipitation, controlled for year. We found 12%(p-value<0.05) and 21%(p-value<0.05) increase in dengue cases per month per 1ºF increase in average monthly temperature and dew point respectively, while an one inch increase of precipitation per month led to 5% increase in dengue cases, but was not statistically significant. Conclusions: The radical changes in the seasonal factors of Singapore during the study period and significant association between climate variables and dengue incidence indicate that the unpredictable dengue cases in Singapore could be the hazardous impacts of climate change. Hence, projected changes in the weather patterns suggest that climate change will have a serious impact on the intensity and magnitude of dengue epidemic in the near future. Keywords: Dengue, climate change, Singapore.

Abstract Number	**O-4-19-04**
Presenter	Indra Linina*, Nicolas Berger
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Can climatic factors explain hantavirus incidence variation in Belgium?

Can climatic factors explain hantavirus incidence variation in Belgium? Indra Linina (1,2) Nicolas Berger (2) 1.European Programme for Intervention Epidemiology Training (EPIET), European Centre for Disease Prevention and Control, Stockholm, Sweden 2. Scientific Institute of Public Health, Belgium (WIV-ISP) Introduction: Hantavirus infection is endemic in Belgium, with cases being reported, through a sentinel laboratory surveillance network, annually since 1995-1996. We conducted a study to describe the epidemiology of the disease and explore the impact of climatic conditions on the incidence of hantavirus infection. Methods: We analysed time series of laboratory-confirmed reported hantavirus cases and data on temperature and humidity in Belgium between 1996-2012. We calculated incidence using mid-year population estimates as denominators. We estimated correlation coefficients to examine the association between hantavirus cases and climatic factors. Results: In 1996-2012, the overall mean reported incidence was 2 cases/ 100,000, with the mean annual rate being 3.9/100,000 in Walloon region and 0.4 and 1.4/100,000 in Flanders and Brussels regions, respectively. Incidence in males was 2.4 (95%CI 2.2-2.6) times higher than that in females. Most (34%) cases occurred from May until September. Incidence of hantavirus was positively correlated (r=0.71) with the summer temperature measured two years before the occurrence of the cases. Conclusions: The incidence of hantavirus in Belgium may be affected by climatic factors. Variations in climatic conditions could be used in surveillance of hantavirus infection as an early warning indicator to predict high-epidemic years.

Abstract Number	**O-4-19-05**
Presenter	Wenbiao Hu*, Archie Clements, Gail Williams, Shilu Tong
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

The use of classification and regress tree to predict incidences of dengue in relation to climatic variables and imported dengue cases in Cairns, Australia

Background: Dengue fever (DF) is a viral disease transmitted by Aedes mosquitoes mainly in tropical and subtropical areas of the world. Recently, there are a number of outbreaks of DF in Cairns, a tropical city in Australia. Aims: To explore the possibility of developing a forecast model of DF based on weekly weather variability and imported DF cases in Cairns, Australia. Method: We obtained data from Queensland Health on the numbers of notified DF cases (acquired locally and overseas) in Cairns for the period 1st January 2000 through 31 December 2009. Data on weather (minimum temperature, maximum temperature, relative humidity and vapour pressure) and population were obtained from the Australian Bureau of Meteorology and the Australian Bureau of Statistics, respectively. A weekly time series classification and regression tree (CART) model was used to evaluate the non-linear relationship between weather variability, imported DF cases and locally acquired DF cases. Cross-validation was used to deal with over-fitting and to identify the optimal tree with respect to its predictive ability. Results: The results indicated that locally acquired DF cases were strongly associated with imported DF cases, average minimum temperature and average maximum temperatures at a lag of 1 - 3 weeks. The CART model showed that the relative risk of locally-acquired DF increased by 16.6-fold (expected weekly incidence rates of DF: 40.15/100,000) when average minimum temperature exceeded 24°C at lags of 1 – 3 weeks, average maximum temperature was under 32°C at lags of 1 – 3 weeks and imported DF case is over 0 at lags of 1 – 3 weeks. Conclusion: These findings may have significant implications for developing a local forecast model to predict DF outbreaks, which can be applied as a decision support tool in planning DF control and prevention programs based on routinely collected data.

Abstract Number	**O-4-19-06**
Presenter	Shahera Banu*, Wenbiao Hu, Yuming Guo, Cameron Hurst, Shilu Tong
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Projecting the impact of climate change on dengue transmission

Background There is increasing interest in assessing the potential impacts of global climate change on vector-borne diseases as the abundance and transmission potential of vectors and people's behaviour are affected by weather conditions. Empirical evidence linking weather variations and dengue remains inconsistent and few data are available in some endemic regions like South Asia. Aims Our aim was to assess the impact of weather variability on dengue transmission in a megacity of Dhaka, Bangladesh and project the future climate related dengue risk attributable to climate change. Methods The data were monthly observation on weather and dengue for Dhaka between 2000 and 2010. We estimated the association between monthly weather variables and dengue after adjusting for trend, season and population density. To examine the nonlinear and delayed effects of weather variables, a distributed lag nonlinear model was used. Then, the model results were applied to future climate change situations to generate projections for dengue risk in the 2100. Results Weather variables particularly temperature and humidity were positively associated with dengue transmission and the effects were nonlinear along lags. The effects of weather variables were observed at a lag of four months. Assuming a temperature increase of 3.3oC by 2100, there will be a projected increase of 16,030 dengue cases in Dhaka. Conclusions There would be a substantial increase in dengue in Dhaka if the temperature increases according to the IPCC climate projection. This information might be helpful for the public health authorities to prepare for the likely increase of dengue due to climate change.

Abstract Number	**O-4-20-01**
Presenter	Payam Dadvand*, Xavier Basagaña, Francesc Figueras, David Martínez, Rob Beelen, Marta Cirach, Audrey de Nazelle, Gerard Hoek, Bert Brunekreef, Bart Ostro, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Air Pollution and Preterm Premature Rupture of Membranes: A Spatiotemporal Analysis

Background: Preterm premature rupture of membranes (PROM) is the leading identifiable cause of preterm birth. Although maternal exposure to air pollution can have a potential impact on preterm PROM, the available evidence on such an impact is nonexistent. Aims:To investigate the association between maternal exposure to NO2, NOx, PM10, PM2.5, PM2.5-10 and PM2.5 light absorption and preterm PROM and gestational age (GA) at rupture of membranes (ROM). Methods: This study was based on 5,555 pregnant women residing in Barcelona, Spain (2002-2005). A spatiotemporal exposure assessment framework was applied using land use regression models to predict pollutant levels at the geocoded address of each study participant's residence during each week of her pregnancy. We conducted both matched (based on the length of exposure) and unmatched case control analyses to abstract the risk of preterm PROM in association with one interquartile range increase in the pollutant exposure levels during the entire pregnancy and the last three months of pregnancy, truncated at the date of ROM. Results: We found less than a day reduction in GA at ROM and 42% (95% CI: 1%, 101%), 37% (3%, 82%), and 50% (4%, 116%) increase in the risk of preterm PROM associated with an IQR increase in exposure to NO2, NOx, and PM2.5 absorbance during the entire pregnancy. For the exposure during the last three months, we observed similar but stronger associations for these pollutants and the reduction in GA at ROM reach to 1.3 day in association with PM2.5 absorbance during this period. The findings for the preterm PROM were consistent in matched and unmatched case-control analyses. Conclusions: Our study showed some evidence for an increased risk of preterm PROM and a small decrease in gestational age at ROM associated with exposure to PM2.5 absorbance, NO2, and NOx.

Abstract Number	**O-4-20-02**
Presenter	Adeladza Amegah*, Jouni Jaakkola
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cross-sectional study

Work as a street vendor and risk of adverse pregnancy outcomes in Accra, Ghana

Background: Street vending is a dominant occupation in urban areas of developing countries due to the massive influx of rural dwellers into urban environment in search of better livelihood. Although it is widely known that street vending exposes individuals to several environmental pollutants very few studies have investigated the health effects of these exposures among street vendors. The relationship of street vending with pregnancy outcomes has not been examined. Aims: To assess the outdoor air pollution exposure experiences of women street vendors in Accra, Ghana and examine it effects on birth weight and gestational duration. Methods: A cross-sectional study was conducted among 105 street vendors and a reference group of 281 mothers accessing postnatal services at the Korle Bu Teaching Hospital in Accra, Ghana in 2010. Results: Multivariate linear regression analysis adjusting for age, social class, marital status and gravidity of mothers, sex of neonate, and indoor air pollution, resulted in 177g (95% CI: 324, 31) reduction in birth weight among street vendors. Sensitivity analysis performed by restricting the analysis to term births resulted in further reductions in birth weight. Generalized linear models adjusting for confounders indicated a 35% (RR=1.35; 95% CI: 0.87, 2.12) increased risk of low birth weight (LBW). The effect measure increased in the sensitivity analysis but was not statistically significant. Upon applying the ordinal scale exposure parameter, moderate exposure was associated with a statistically significant 95% (RR=1.95; 95% CI:1.03, 3.70) increased risk of LBW. The risk of preterm birth was not associated with street vending (RR=1.03; 95% CI: 0.67, 1.58). Conclusions: Street vending during pregnancy is a determinant of average fetal growth and risk of LBW. More research is required to further quantify their effects on pregnancy outcomes and provide the evidence base for interventions to safeguard maternal and perinatal health in developing countries.

Abstract Number	**O-4-20-03**
Presenter	Olivier Laurent*, Jun Wu, Lianfa Li, Jianlin Hu, Myles Cockburn, Mike Kleeman
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Preeclampsia and exposure to ozone and particles in Los Angeles County, California

Background The relationships between air pollution and preeclampsia, a pregnancy-related condition characterized by hypertension and proteinuria, have seldom been studied. Aims To study the relationships between preeclampsia and exposure to ozone and particles by size-fraction and emission source in Los Angeles County (California, USA) over period 2000-2005. Methods Primary particle matter concentrations were modeled at a 4 km*4 km grid resolution, by emission source (high sulfur fuel , diesel, gasoline, wood, cooking, shipping and others) for ultrafine (PM0.1), fine (PM2.5), and coarse (PM10) fractions. Besides, ambient ozone (O3) and total PM2.5 concentrations measured by monitoring stations were interpolated using empirical Bayesian kriging. Birth certificates (n= 675,838) with maternal addresses at delivery were geocoded at parcel level whenever feasible. Analyses of the relation between preeclampsia and air pollutants were conducted using generalized additive models, adjusting for maternal age, parity, race/ethnicity, education, renal diseases, chronic hypertension, diabetes, prenatal care, neighborhood income, and temporal trends. Results Preeclampsia (n=11,792) was positively associated with exposure to ozone and to primary particle mass from wood burning (PM10 and PM2.5 fractions), but negatively associated with primary particles from most other sources for all fractions, and with total PM2.5 measured by monitoring stations. Conclusions The reasons why decreases in preeclampsia risk are associated with total PM2.5 and with primary particles from most assessed sources are unclear. Maternal smoking is known to reduce preeclampsia risk and might have acted as a confounding factor. The positive associations observed with ozone and wood burning deserve further investigation.

Abstract Number	**O-4-20-04**
Presenter	Marie Pedersen*, Lise Giorgis-Allemand, Mark J Nieuwenhuijsen, Göran Pershagen, Ulrike Gehring, Bert Brunekreef, Manolis Kogevinas, Rémy Slama
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

BIRTH WEIGHT, HEAD CIRCUMFERENCE AND EXPOSURE TO AMBIENT AIR POLLUTION DURING PREGNANCY: A EUROPEAN COHORT STUDY (ESCAPE)

Background: Adverse effects of ambient air pollution on foetal growth have been reported, but findings are inconsistent. Aims: We evaluated the impacts of exposure to traffic-related air pollution during pregnancy on newborn size using standardized exposure assessment taking into account fine-scale spatial and temporal contrasts. Methods: We harmonised and pooled data on 74,000 singleton births (1994–2011) from 14 cohorts in 12 European countries, and applied the same protocol within the European Study of Cohorts for Air Pollution Effects (ESCAPE). Ambient nitrogen dioxide (NO2), nitrogen oxides (NOX), particulate matter (PM10, PM2.5), PM2.5–10 and PM2.5 absorbance (soot) concentrations at the home addresses during pregnancy were estimated using temporally adjusted land-use regression models. Linear and logistic regressions were used to estimate associations. Results: Pregnancy mean exposure (µg/m3) was 26.2 for NO2 (5–95th percentiles: 11.7–45.8), 25.4 (11.6 –39.1) for PM10 and 16.5 (8.8–24.9) for PM2.5. Pregnancy mean exposure to PM2.5 was associated with an increased odds of 1.18 (1.06, 1.33) for term low birth weight (<2,500 g among births after 37 weeks of gestation), a decrease by -10 (-19, -1) g in mean birth weight, and -0.08 (-0.12, -0.03) cm in mean head circumference per 5µg/m3 increment in PM2.5 after adjustment for individual information on potential confounders. A 10-µg/m3 increase in NO2 and PM10 were associated with an increased risk of term low birth weight (1.09 (1.00, 1.19) and 1.16 (1.00, 1.35)). Reductions in head circumference were also observed for the other pollutants. Conclusions: In this large European cohort study using standardized exposure assessment maternal exposure to ambient air pollution from traffic emissions during pregnancy was associated with reduced foetal growth. Risk estimates are higher than those of previous meta-analyses based on different or less harmonized exposure metrics.

Abstract Number	**O-4-20-05**
Presenter	Bram Janssen*, Lode Godderis, Nicky Pieters, Katrien Poels, Michal Kicinski, Ann Cuypers, Frans Fierens, Joris Penders, Jaco Vangronsveld, Wilfried Gyselaers, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cross-sectional study

Placental DNA hypomethylation in association with particulate air pollution in early life

Background: There is evidence that altered DNA methylation is an important epigenetic mechanism in prenatal programming and that developmental periods are sensitive to environmental stressors.Aims: We hypothesized that exposure to fine particles (PM2.5) during pregnancy could influence DNA methylation patterns of the placenta.Methods: In the ENVIRONAGE birth cohort, levels of 5'-methyl-deoxycytidine (5-mdC) and deoxycytidine (dC) were quantified in placental DNA from 240 newborns. Multiple regression models were used to study placental global methylation and in utero exposure to PM2.5 over various time windows during pregnancy.Results: PM2.5 exposure during pregnancy averaged (25th-75th percentile) 17.2 (15.3-19.1) µg/m3. Placental global DNA methylation was inversely associated with PM2.5 exposures during whole pregnancy and decreased by 1.94% (95% confidence interval (CI): -3.88, -0.01%, p = 0.05) for each 5 µg/m³ increase in exposure to PM2.5. The corresponding trimester specific estimate was -1.80% (95% CI: -3.26, -0.35%, p = 0.016) for the first trimester, while no significant association was observed with PM2.5 exposure of the second trimester (-0.92%, 95% CI: -2.35, 0.50%, p = 0.21) and the third trimester (-0.88%, 95% CI: -2.16, 0.39%, p = 0.18). When we analyzed smaller time windows of exposure within trimester 1, we observed a lower placental methylation at birth of -1.53% (95% CI: -2.45, -0.23%, p = 0.0012) and -1.22 % (95% CI: -1.91, -0.52%, p = 0.0008) for each 5 µg/m³ higher PM2.5 exposure during the implantation stage and the post-implantation stage respectively.Conclusions: We observed a lower degree of global placental methylation in association with exposure to particulate air pollution in early pregnancy. Moreover, we show that global DNA methylation is affected during the critical stages of implantation. Future studies should elucidate genome-wide and gene-specific methylation patterns in placental tissue that could link particulate exposure during in utero life and early epigenetic modulations.

Abstract Number	**O-4-21-01**
Presenter	Vivian C. Pun*, Zibing Yuan, Kin-fai Ho, Hong Qiu, Ignatius T. S. Yu, Linwei Tian
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Short-term associations between sources of particulate matter pollution and emergency hospital admissions in Hong Kong

Background: Despite decades of evidence linking PM pollution with adverse health effects, significant knowledge gap remains regarding the health impacts of PM sources. Like size and chemical composition, PM sources appear to determine PM's toxicological characteristics. Aims: We examined the short-term impacts of source-specific PM10 mass and daily emergency hospital admissions in Hong Kong. Methods: Concentrations of 18 PM10 chemical components measured between 2001 and 2007 were analyzed via positive matrix factorization source apportionment. Generalized additive models were used to estimate source-specific excess risks at lags 0-3 days for cardiovascular (CVD) and respiratory (RESP) hospital admissions, adjusting for weather, seasonal/temporal trends, day-of-week and influenza epidemic. Results: Eight PM10 sources were identified: vehicle exhaust, soil/road dust, regional combustion, residual oil, fresh and aged sea salt, secondary sulfate and secondary nitrate. Secondary sulfate, vehicle exhaust and regional combustion contributed over half of the PM10 mass. An inter-quartile range increment in secondary nitrate (7.4 µg/m3) was associated with the largest percent increase of hospital admissions (1.8%; 95% CI: 1.2-2.5 at lag 0 for CVD; 1.4%; 95% CI: 0.8-2.0 at lag 3 for RESP), followed by vehicle exhaust and aged sea salt. Different sources were found to be variably associated with different outcomes: vehicle showed stronger associations with RESP, regional combustion and residual oil with CVD. Associations with PM10 from soil/road dust, secondary sulfate and fresh sea salt were mostly insignificant. Conclusions: Findings suggest that secondary nitrate from mobile sources and other fuel combustion, and vehicle exhaust are major contributors to the increased hospital admissions linked to PM10. Aged sea salt from regional transport of sea salt that passed through other polluted air is also an important risk factor for adverse health effects in coastal cities.

Abstract Number	**O-4-21-02**
Presenter	Kathrin Wolf*, Massimo Stafoggia, The ESCAPE cardiovascular working group*, Annette Peters, Francesco Forastiere
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	meta-analysis

Associations between long-term exposure to particulate matter constituents and the incidence of coronary events in European cohorts

Background. Long-term effects of air pollution and thereof especially particulate matter (PM) have been associated with increased cardiovascular morbidity and mortality. However, little is known about the influence of chemical PM components. Aim. To assess the effects of residential long-term exposure to PM components on the incidence of coronary events as part of the ESCAPE (European Study of Cohorts for Air Pollution Effects, www.escapeproject.eu) and TRANSPHORM (www.transphorm.eu) projects. Methods. Nine cohorts from Finland, Sweden, Denmark, Germany, and Italy participated in this analysis. 4,798 incident coronary events were identified from 86,852 persons followed on average for eleven years. Long-term residential concentrations of PM<10µm (PM10), PM<2.5µm (PM2.5) and selected constituents (copper, iron, potassium, nickel, sulfur, silica, vanadium, zinc) were estimated with land-use regression models based on a standardized procedure. Cox proportional hazard models adjusted for a common set of confounders were used to estimate cohort-specific component effects with and without including total PM. Random effects meta-analyses were used to pool cohort-specific results. Results. In the nine cohorts, a 5 µg/m³ increase in PM2.5 and a 10 µg/m³ increase in PM10 were associated with a 15% (95%-confidence interval: [-1;34%]) and 11% [-1;24%] increase in coronary events, respectively. PM2.5 and PM10 potassium concentrations were associated with risk increases of 19% [6;34%] and 7% [1;13%] per 50 and 100 ng/m³ increase (cohort-specific IQRs ranging from 0 to 39 and 7 to 144 ng/m³), respectively. When additionally adjusting for total PM, potassium effects slightly strengthened. Other PM constituents showed no significant effect on coronary events. Conclusion. The preliminary results of nine cohorts suggest an association between long-term exposure to PM potassium and incidence of coronary events. The final results of eleven cohorts will be presented at the conference.

Abstract Number	**O-4-21-03**
Presenter	Petter L. Ljungman*, Elissa Wilker, Mary B. Rice, Joel D. Schwartz, Diane R. Gold, Petros Koutrakis, Emelia Benjamin, Joseph Vita, Gary Mitchell, Murray A. Mittleman
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Short-term exposure to air pollution and digital vascular function in the Framingham Heart Study

Background Air pollution has been shown to have acute vascular effects. However, there are few community-based studies of the impact on small vessel function. Aims To investigate associations between ambient air pollution and small vessel function measured by peripheral arterial tonometry (PAT) in the Framingham Offspring and Third Generation Cohorts. Methods A total of 1940 participants living within 40 km of the Harvard Supersite were included of which 992 were free of antihypertensive or statin medications. Hourly data from the monitors were used to calculate moving averages of air pollution for 1, 2, 3, 5 and 7 days before PAT measurement for PM2.5, Black Carbon (BC), and nitrogen dioxide (NO2). The ratio of the fingertip pulse wave amplitude pre- and post- forearm occlusion was divided by the same ratio in the contralateral non-occluded arm and log transformed for normality (PAT ratio). We fit multivariable linear regression models adjusted for age, sex, body mass index, smoking status, diabetes, lipids, cohort, long term time trends, day of week, season, temperature, and relative humidity to estimate associations with air pollutants. Results Results were close to the null with wide confidence intervals in the full sample. However, in participants not taking antihypertensive or statin medications, 1 to 3 day moving averages of PM2.5 , were all consistently associated with PAT. The strongest associations were seen for 2 day moving averages of PM2.5 with 11.6% higher baseline pulse amplitude per 5 µg/m3 (CI 5.1 to 18.5%) and 6.5% lower hyperemic response (PAT ratio) per 5µg/m3 (CI -3.2 to -9.6%). Similar results were seen for BC and NO2. Results were not materially altered when current smokers or participants with diabetes were excluded. Conclusions Short-term exposures to air pollution were associated with impaired microvascular response in participants not taking antihypertensive or statin medications in the Framingham Offspring and Third Generation cohorts.

Abstract Number	**O-4-21-04**
Presenter	Giulia Cesaroni*, Chiara Badaloni, Claudio Gariazzo, Massimo Stafoggia, Roberto Sozzi, Marina Davoli, Francesco Forastiere
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term exposure to air pollution and incidence coronary and cerebrovascular events in the Rome Longitudinal Study

Background Although several studies found an association between air pollution exposure and mortality risk, especially for ischemic heart diseases (IHD), few studies have examined the effect on the incidence of coronary and cerebrovascular events. Aims We studied the association between long-term exposure to ambient air pollution at residence and the incidence of coronary events and stroke in a population-based cohort, the Rome Longitudinal Study (Cesaroni et al. EHP 2013). Methods The Rome Longitudinal Study includes 1,265,058 adults with 9 years of follow-up. Residential exposure to annual NO2 (by land use regression model) and PM2.5 (by Chemical Transport model) were available. We used Cox regression to evaluate the association between pollutants and incidence of coronary events and stroke (including fatal events, i.e. deaths within 28 days from the event), adjusting for several individual and contextual factors. Results A total of 38,377 and 27,825 subjects experienced incident coronary events and stroke, respectively. An increase of 10 µg/m3 in NO2 was associated with a increased risk of coronary events (HR=1.02, 95% CI: 1.01-1.03). No association was found between NO2 and incidence of stroke. PM2.5 was not associated with incidence of both stroke and coronary events. However, residential exposure to both NO2 and PM2.5 was associated with an increased risk of fatal events. An increase of 10µg/m3 in NO2 was associated with fatal coronary events (HR=1.07, 95%CI: 1.04-1.09) and fatal stroke (HR=1.03, 95%CI: 1.00-1.07), and an increase of 10µg/m3 in PM2.5 was associated to both fatal coronary events (HR=1.15, 95%CI: 1.07-1.15) and fatal stroke (HR=1.15, 95%CI: 1.08-1.23). Conclusions This study showed an association between exposure to air pollution and incidence of coronary events and incidence of fatal coronary events and stroke.

Abstract Number	**O-4-21-05**
Presenter	Yi Wang*, Melissa Eliot, Gregory A. Wellenius
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	meta-analysis

Ambient Particulate Matter (PM) and Stroke: a Review and Meta-analysis

Background: Short-term exposure to ambient particulate matter (PM) may be associated with increased risk of mortality and hospital admission for total cerebrovascular disease (CBVD), ischemic stroke (IS) or hemorrhagic stroke (HS), but the results have been inconsistent. Aims: To summarize the evidence of an association between short-term exposure to PM and mortality and hospital admission for CBVD, IS or HS. Methods: We conducted a systematic search of relevant epidemiological studies indexed by PubMed, Web of Knowledge, or Embase in English before February 2012.Two reviewers independently extracted key characteristics of each study and effect estimates for single-day lags up to 4 days and cumulative lags up to 4 days prior to the day of event. We used a random-effects model to estimate a summary incidence rate ratio (IRR) per a 10 µg/m3 increase in PM. We assessed publication bias with funnel plots and Egger's asymmetry test. Results: We identified 32 studies from 480 relevant articles. CBVD mortality was positively associated with both PM10 and PM2.5 with summary IRR (95% CI) of 1.005 (1.003, 1.008) and 1.014 (1.008, 1.020), respectively. Rates of CBVD hospital admissions were also positively associated with PM10 and PM2.5, with summary IRR of 1.003 (0.997, 1.008) and 1.014 (1.004, 1.012), respectively. One studies suggested there was evidence of an association between IS mortality and PM2.5 and no study has studied the association between HS mortality and both PM10 and PM2.5. Results across studies were less consistent for the association between IS hospital admissions and both PM10 and PM2.5, with the summary IRR including the null hypothesis of no association. There was little evidence of an association between HS hospital admissions and either PM10 or PM2.5.There has no apparent publication bias in meta-analyses. Conclusions: There is evidence of an association between PM and both CBVD mortality and hospital admission, but less consistency among studies specifically of IS and HS hospital admission.

Abstract Number	**O-4-21-06**
Presenter	Kristen C. Malecki*, Lynne Morgan, Javier Nieto, Thomas Burke
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Cumulative Health Impacts of Air Quality and Social Vulnerability on Cardiopulmonary Health: Results from the Survey of the Health of Wisconsin

Background: Despite calls for improved cumulative risk assessments, there are a limited empirical data to support integration of data on both chemical mixtures and non-chemical stressors available to regulators. Recently, the US EPA reduced National Ambient Air Quality Standards (NAAQS) for annual ambient PM2.5 from 15 to 12 ug/m3 and epidemiologic studies of the effectiveness of these standards in light of social vulnerability are needed. Aims: Study the distribution of low-level chronic air quality (PM2.5 and ozone) with poor lung function and adverse cardiovascular events (i.e., cardiopulmonary health (CPH)) in a population-based sample and examine interactions with non-chemical stressors (socio-demographic and psychosocial factors). Methods: Social and built environment determinants of CPH were measured in 2479 adults 21-74 from the Survey of the Health of Wisconsin. Annual average county-level monitoring and hierarchical Bayesian estimates (36 km grid) of PM2.5 and Ozone were linked using GIS. Associations between CPH and annual air quality estimates and interactions with education, income, depression, anxiety, stress, discrimination and life events were explored while adjusting for confounders (age, gender, race/ethnicity, body-mass index or smoking status). Results: Overall, chronic air-quality exposures at levels below current standards were not associated with significant decreases in markers of CPH risk (FEV1, blood-pressure, cholesterol, leukocyte counts). The effect of PM2.5 on FEV1 (l/ug/m3)in the entire sample was not significant (-.03, p<.08). In stratified analyses, no significant effect was found among participants with greater than high school education (-.02, p<0.35) but a significant association among those with less than high school education was observed (-.08, p<.04). Conclusions: Findings underscore the potential for increased health risks to vulnerable sub-populations. Non-chemical stressors must be considered in cumulative risk assessment in order for standards to be fully protective and address persistent health disparities.

Abstract Number	**O-4-22-01**
Presenter	Tunga Salthammer*
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	others

Formaldehyde in the ambient atmosphere - from an indoor pollutant to an outdoor pollutant?

Background: Formaldehyde has been in discussion as a typical indoor pol-lutant for decades. Legal requirements and ever-lower limits for indoor air have led to a continual reduction in the amount of form--aldehyde released from furniture, building materials and house-hold products over many years. Results: Slowly, and without much at-tention from indoor related research, a change of paradigm is taking place, however. The formaldehyde concen-trations in out-door air, particularly in urban areas, are increasing and have sometimes already reached indoor levels. In the medium term, this develop-ment will lead to consequences for the way buildings are ven-tilated and to a change in the way we evaluate human exposure. In our urban environment, average formaldehyde concentrations up to 40 ppb indoors and 15 ppb outdoor can be considered as normal. "Normal" is, however, not to be confused with "safe" or "acceptable". It should simply be noted that, under current environmental policies, formaldehyde as an air pollutant is a consequence of our industrial society. The increasing use of biofuels combined with the continuously increasing traffic density will certainly lead to higher concentrations of formaldehyde and other pollutants. Although formaldehyde has not yet fully moved from being on indoor air pollutant to being an outdoor air pollutant, the differences in indoor and outdoor concentration levels are, however, becoming smaller and in several cases an overlap can already be witnessed. Conclusions: While authorities, research institutes and industry are making great efforts to develop lower and lower emis-sion building products, massive industrial expansion, increasing energy consumption and the desire for more mobility are having a range of negative consequences on the air quality. There will also have to be more research on how hou-sing can be effectively ventilated in high-pollution areas, not only in terms of the energy involved, but also with regard to health as-pects.

Abstract Number	**O-4-22-02**
Presenter	Heidrun Hofmann*, Michael Köhler, Andreas Müller, Jörg Mertens, Ulrike Siemers, Norbert Weis
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	others

The AGÖF-VOC Database (2002-2012)

The AGÖF-VOC Database (2002-2012)Heidrun Hofmann, Michael Köhler, Andreas Müller, Jörg Mertens, Ulrike Siemers, Norbert WeisBackground and aimsPollution with volatile organic compounds (VOC) is still an important topic of indoor air hygienic evaluation of living and habitable rooms. Evaluations of single measurements are frequently derived from statistical reference values. The formation of these reference values is ideally based on various background information. For example the shift of the substances spectrum over time, cofactors such as age and energy efficiency of the building, the latest point of renovation, specific decor characteristics as well as details about the used analytics. It's the required close linkage that makes the usage of a database valuable.MethodsThe working group of ecological research institutes (Arbeitsgemeinschaft ökologischer Forschungsinstitute, AGÖF) collected in two research projects supported by the federal environmental agency, 7.421 VOC data records from the years 2002 to 2012 with 964.788 measuring points based on a MS Access data base. Beside the VOC data, the reason for the investigation, the type, age, usage, decor and venting possibilities inside the building as well as occasionally data concerning the energy efficiency were recorded. Descriptions of the sampling and the analytics were integrated, too. The data base has been provided with user-friendly analyses possibilities for the automatic generation of spefic values and for filtration of underlying single data.Results and conclusionStatistical parameters (percentile, minimum, maximum) have been evaluated for the description of the appearance of more than 500 VOC. Based on the data pool it is possible to systematically describe correlations and influencing factors for the appearance of VOC in central European interior rooms. Below you find some analyses examples of particular interest.

Abstract Number	**O-4-22-03**
Presenter	Atze Boerstra*, Marcel G.L.C. Loomans, Jan L.M. Hensen
Exposure	others
Health domains	other
Type of research	occupational study

Personal control over indoor climate and it's impact on comfort, health and performance of office workers

Traditional indoor air quality and thermal comfort standards prescribe ideal indoor environments in terms of e.g. minimum fresh air supply rates, maximum pollutant concentrations or minimum winter and maximum summer temperatures. The important aspect of personal control over indoor climate is not addressed in these standards which is rather peculiar as indoor climate complaints seem most prominent in buildings without adjustable thermostats, operable windows and other controls. A field study was designed. The objective of the study was to find out how much control Dutch office workers perceive to have over temperature and ventilation and to identify what factors influence perceived control levels. A second objective was to investigate how perceived control over indoor climate in offices affects comfort, health and (self-assessed) performance. The field study was carried out in 9 Dutch office buildings in the winter of 2011/12. The study consisted of i. a systematic inventarisation of relevant building and HVAC system characteristics, ii. a questionnaire amongst building occupants and iii. indoor climate measurements. This paper focuses on the questionnaire outcomes and presents correlations between perceived control and endpoint effects like (self-reported) comfort, health and performance. The study showed that perceived control over temperature and ventilation was much lower than perceived control over e.g. sun penetration and light. Factors that determine perceived level of control over indoor climate are for distance from one's workstation to the facade and the amount of other people one shares his/her workspace with. Those that perceive to have a high amount of control over their indoor climate are significantly more comfortable and productive and have significantly less building related symptoms (SBS). The conclusion was that personal control over indoor climate matters and therefore should be adressed in future standards.

Abstract Number	**O-4-22-04**
Presenter	Kanyiva Muindi*, Thaddaeus Egondi, Joacim Rocklöv, Elizabeth Kimani, Remare Ettarh, Nawi Ng
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

"We are used to this": Perceptions of slum residents on air pollution

Introduction: Urban air pollution remains a major health risk to millions of urban residents worldwide. In developing countries, economic growth is over-emphasized ignoring attendant environmental issues. Addressing urban air pollution requires an all-inclusive approach, it is therefore important to understand people's perceptions which are an important factor in the pathway between exposure and health complaints and also in pollution mitigation efforts. Objectives and Methods: This study set out to assess the perceptions and attitudes of residents in two slum communities in Nairobi regarding outdoor and indoor air pollution. We conducted emergent focus group discussions with residents aged 18 years and above. Results: The results reveal that residents are aware of the sources of air pollution. There are mixed opinions on who is responsible for pollution with some blaming it on residents, "… disposal of garbage all over …we collect and burn this trash this pollutes the air. It starts with us…" Others blame sources external to the community "There is this garbage centre that emits a lot of smoke and eventually the smoke gets here…" There were sentiments of fatalism when asked whether residents worry about air pollution; "… we have got used to this until we forgot it is a problem" Other interlocutors expressed helplessness; "…the problem is where we can get help because we live in a poor area, what can we do and this is where we can live?" Discussion: Residents know the sources of pollution; however, there is dissonance between this knowledge and action to reduce pollution. There is evidence of 'settling into the situation' with residents seeing no need to act in order to reduce pollution. There is need for community-wide education on environmental hygiene and involvement of those identified as polluters around the communities.

Abstract Number	**O-4-22-05**
Presenter	
Exposure	others
Health domains	allergies
Type of research	cross-sectional study

Effect of indoor musty smell as a surrogate of housing inequalities on poor well-being: US NHANES, 2005-2006

BackgroundHousing inequality may pose a significant social problem in the society. There are numerous studies investigating housing effect on human health, but not on the musty smell. Therefore, it was aimed to determine the relationship of musty smell and individual well-being in a national and population-based setting. MethodsData were retrieved from United States National Health and Nutrition Examination Surveys, 2005-2006 including demographics, self-reported mildew odor or musty smell, and self-reported chronic diseases. Analyses included t-test, chi-square test, and logistic regression modeling. All models were also weighted for survey design. ResultsOf all people included (n=10,348), 48.1% were adults (n=4,979). 744 (15.1%) reported that there was a mildew odor or musty smell in the last 12 months. After adjusting for age, sex, ethnicity, survey weighting, and house age, it was observed that those who reported a mildew odor or musty smell in the household also reported a poorer self-rated health (OR 1.37, 95%CI 1.16-1.61, P=0.001) and depression episode (OR 1.30, 95%CI 1.09-1.56, P=0.007). They tended to have itchy (OR 1.92, 95%CI 1.55-2.37, P<0.001), sneezing (OR 1.38, 95%CI 1.14-1.68, P=0.003), and vision problem (OR 1.94, 95%CI 1.25-3.01, P=0.006). Other health outcomes included chronic bronchitis, heart failure (borderline), asthma, and arthritis. ConclusionsPeople who reported a mildew odor or musty smell in the house also reported a poorer health symptoms and outcomes. Future research with longitudinal design is needed to confirm the current observations and public health programs might need to consider including the elimination of musty smell in the household.

Abstract Number	**O-4-22-06**
Presenter	Thomas Götschi*
Exposure	green spaces
Health domains	physical activity
Type of research	exposure measurement

On-site data collection of environmental attributes and subject data using OpenDataKit/Formhub open-source software for Android mobile devices

Background: Spatial attributes of built and natural environments are important predictors in spatial analyses of various outcomes, such as physical activity behavior or health effects from air pollution. Until recently, spatial data collection through on-site audits or interviews has been tedious and costly. New mobile technology offers opportunities for epidemiologic research. Aims: As part of the project "Community on the move [Gemeinde bewegt]" - a pilot project on physical activity and structural factors - a tool for participatory environmental audits by pedestrians and cyclists was developed. Methods: Android-based open-source software (opendatakit.org and formhub.org, ODK/FH) for mobile data collection was used to create a form which records geo-location, requests information on issue of interest, infrastructure, problem at hand and suggested solutions, and captures photos. Forms are easily created in Excel, then on formhub.org converted to XML suited for mobile devices. Data is collected with tablets and uploaded via wireless connection to formhub.org, from where it can be exported for analysis. Online data entry is possible as well. GPS accuracy was evaluated in a separate effort comparing three different tablet types. Community audits with stakeholders were conducted in two and are planned in eight more communities. Assessment of bicycle accident locations will be used in a case-crossover safety study. Results: ODK/FH allows for simple creation and changes of forms or questionnaires for mobile devices without requiring programming skills. GPS accuracy of tested tablets ranges from under 10m up to 30m, sufficient to uniquely identify typical locations of interest in combination with attribute data. Development of forms, handling of the tool, users and data are substantially less time consuming than traditional paper-based approaches. Conclusions: ODK/FH provides a free, efficient and flexible option for on-site collection of environmental attribute and subject data of interest in epidemiologic research with or without spatial components.

Abstract Number	**O-4-23-01**
Presenter	John Havermans*, Rene Dekker, Richard Correl
Exposure	pesticides
Health domains	other
Type of research	case-control study

The impact of a historical conservation methods for the preservation of entomological collections

Background Museums of Natural History serve community and science by paying serious attention to understanding biodiversity. Recently Dutch entomological collection from different institutes have been combined into one main collection. The collection preservation was based on moth-balls (naphthalene). Aim To establish risks for the occupational health of working with the entomological collection before and after moving and impriving the indoor air quality. Methods The indoor air quality of the old and new storage room was evaluated by analyzing air samples and measuring the ventilation rates. TenaxGR was used for the adsorption of VOCs and DNPH cartridges were used for the adsorption of volatile carbonyls. Additionally the wooden cabinets were subjected to a climate chamber emission test. Results The old repository contained over 800 cabinets with 10 drawers each (filled with 5-6 moth-balls). The highest concentration observed of naphthalene and formaldehyde indoor were subsequently 9300 and 169 µg/m3. The formaldehyde concentration exceeded the Dutch threshold limit value of 150 µg/m3. Chamber emission tests on the wooden cabinets indicated that they emit mainly formaldehyde. All moth-balls were removed and the collection was moved. Although the repository had air purification naphthalene and formaldehyde were present at high concentrations. Formaldehyde exceeded again the Dutch threshold limit value resulting in closing the storage rooms for workers. After evaluating the current purification system it was concluded that a wrong filter medium was applied. Additional tests showed that a combination of filters was able to reduce both the concentration naphthalene and formaldehyde. Conclusions Old preservation methods could have a high impact on working with collections due to the emission of harmful volatiles. In our case only improving the air purification the concentration of contaminants indoors could be reduced significantly.

Abstract Number	**O-4-23-02**
Presenter	Carlijn Wentink*, Berna van Wendel de Joode
Exposure	pesticides
Health domains	other
Type of research	others

Grasping the Blue Bags; A Qualitative Study of Perceptions on the Continuous Use of Chlorpyrifos-Treated Bags in Plantain Production

Background: Plantain production is a major income-source in the Bribri and Cabécar Indigenous Territories in Talamanca, Costa Rica. During production, blue chlorpyrifos-treated bags (hereafter named 'blue bags') are placed around the bunches to protect the plantain's peel from stains. Although exposure to the insecticide chlorpyrifos causes adverse health and environmental effects, and alternative production methods do exist, growers continue to use the blue bags. Underlying motives for this behaviour are unknown. Aim: To map plantain producers' reasons for the continuous use of the blue bags, in the context of the production system. Methods:To explore the perceptions of producers and other relevant actors, an exploratory, qualitative study has been conducted. Data were collected based on a literature review and semi-structured interviews with 31 plantain producers, 11 intermediaries, 2 hired workers, 3 governmental organizations and 5 ngo's. Results: Both the literature and the interviews showed that economic restrictions are key to the continuous use of the blue bags and that producers are dependent of the quality rules of intermediaries. Moreover, environmental pollution (by littering bags) is of greater concern to most respondents than health risks (by insecticide exposure). A higher price is paid for bagged plantain because of existing aesthetic quality demands on the national market. Most respondents perceive blue bag-use as a necessity to operate on the national market. Conclusions: Economic considerations were found to be the main reason for the continuous use of the blue bags due to buyers' demand of aesthetic quality. Economic dependency on plantain production and income insecurity are barriers to change towards alternative methods. The finding that most participants perceive environmental problems a bigger concern than health risks is a barrier towards change.

Abstract Number	**O-4-23-03**
Presenter	Rachel Raanan*, John R. Balmes, Kim Harley, Asa Bradman, Nina Holland, Michelle Vedar, Mark Miller, Brenda Eskenazi
Exposure	pesticides
Health domains	respiratory disease
Type of research	cohort study

IN UTERO ORGANOPHOSPHATE EXPOSURE ASSOCIATED WITH RESPIRATORY SYMPTOMS IN CHILDREN IN THE CHAMACOS COHORT

Background: Although pesticide use is widespread, the contribution of prenatal and early childhood organophosphate (OPs) exposure to respiratory disease and asthma in children are not well described. Aims: To evaluate the associations between prenatal and early childhood OPs exposure and respiratory symptoms in children. Methods: Participants were 343 children and mothers enrolled in the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) birth cohort. Urinary dialkylphosphate (DAP) metabolites of organophosphate pesticides comprised of diethyl (DE) and dimethyl (DM) DAPS were measured twice during pregnancy (M±SD=13.5±4.8, 26.4±2.4 weeks gestation) and 5 times during childhood (6-60 months). Area under curve (AUC) was determined for childhood exposure. Mothers were interviewed about respiratory symptomatology of the child at age 5 and 7. Regression models controlled for maternal smoking during pregnancy, environmental tobacco smoke, season of birth, PM2.5 in first 3 months of life and interaction by sex. Results: Urinary DE metabolites from the 2nd prenatal visit were associated with higher odds of respiratory symptoms (aOR=1.7, 95% CI=1.1, 2.8) when children were age 5. DE metabolites concentration at the 1st prenatal visit showed significant interaction with sex (p=0.001) and were associated with higher odds of respiratory symptoms only in girls (aOR=1.9, 95% CI 0.96, 3.9). There was no association with DM phosphate metabolites. Childhood DAP levels (AUC) were associated with higher odds of symptoms (aOR=2.2, 95% CI 1.1, 4.4). Additional analysis will also include results for symptoms at age 7 and spirometry for ages 5 and 7. Conclusions: Prenatal and child urinary DAP concentrations were associated with respiratory symptoms at 5 years of age. Acknowledgements: This work was supported by 2P01ES009605 from NIEHS, RD-82670901, RD-83171001 and RD-83451301 from the U.S. EPA, and the Environment and Health Fund (EHF) Israel. Keywords: prenatal exposure, spirometry, respiratory symptoms, OPs, pesticides.

Abstract Number	**O-4-23-04**
Presenter	Edmund Seto*, Lesliam Quiros-Alcala, Jonah Lipsitt, Lemuel Wu, Philip Kruger, Tsundzukani Ntimbane, Burnie Nawn, Riana Bornman, Brenda Eskenazi
Exposure	pesticides
Health domains	infectious diseases
Type of research	exposure measurement

mSpray: Using cell-phone technology to monitor population exposure to pesticides used for malaria control

Background: DDT and pyrethroids are widely used for Indoor Residual Spraying (IRS) to combat malaria in South Africa and elsewhere. Paper-based records are used to monitor the amount and type of pesticide used, spray coverage and spray operator's performance. These records do not incorporate the exact location of use at the household level. This method of record-keeping may lead to pesticide overuse, development of pesticide resistance, and unnecessary population exposure to potentially hazardous chemicals. Aims: We developed a smart phone "app"called mSpray and pilot-tested its acceptance and utility in capturing accurate GPS-linked information on IRS spray events. Methods: mSpray, uses internet services to determine location of pesticide applications. Data is stored in the phones and transmitted to Google data servers, allowing for remote real-time monitoring of spray operations. Ten cell phones were distributed to 13 spray workers in Vhembe, Limpopo, South Africa to pilot test the application during the 2012-13 malaria spray season. Surveys and focus groups were conducted at the end of the spray season to collect information on user acceptance and identify areas of improvement. Results: More than 1000 spray events were recorded with mSpray. These events could be readily and accurately mapped at the household level with ArcGIS. Surveys and focus groups with spray teams revealed concerns about the functioning of one cell phone and cell phone battery life. Despite this, the majority of users (>75%) felt the system was easy to use and made their jobs easier. All respondents indicated that mSpray was better than the existing paper-based forms. Conclusions: Results demonstrate the potential for mSpray to achieve multiple benefits for efficient malaria control towards elimination and in pesticide exposure assessment and epidemiologic studies. Acknowledgements: This study was supported by the National Institute of Environmental Health Sciences (R01 ES020360-01) and phones were donated by Zinto Activations Group, South Africa.

Abstract Number	**O-4-23-06**
Presenter	Rémi Béranger*, Jeffrey Blain, Elise Billoir, Marie-Laure Bayle, John R. Nuckols, Joachim Schüz, Bruno Combourieu, Béatrice Fervers
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

SIGEXPO project: pesticides exposure level in the french context: burden of environmental exposures and domestic habits

Background:General population spent about 85 to 90 % of their time in indoor environment and higher indoor pesticides level might be related to adverse health effect. It has been suggested that the indoor exposure level to pesticides is increased by residential proximity to agricultural pesticide use, but information on overall domestic pesticides contamination is lacking in the literature. In 2012, we sampled indoor dust of 239 French houses to validate a GIS approach aiming to estimate agricultural contribution to pesticide in household dusts. Aim: To characterize domestic pesticide contamination in the Rhône-Alpes region (France) depending on type of dominant farming in surrounding fields, thus accounting for non-agricultural sources by our measurement data. Methods: We sampled 239 houses: 69 in orchards production area, 66 near corns and grains, 68 near vineyards and 36 houses in an urban area (at least 2000 meters from agricultural fields). During the main period of pesticides applications, we used a polypropylene dust trap (30 days) and isopropanol floor wipes to collect recent (7 days) and older dust (at least 6 month). Farmer and pesticides applicators were excluded from the study. Questionnaires were used to assess household characteristics and related domestic pesticide use. We conducted multi-residue laboratory analyses for 413 pesticides and 102 organic compounds in each sample. Results: 126 pesticides were detected at least one time in houses, and at least 1 in 97% of homes. Of 30 predominant compounds, 10 were non-authorized and 5 non-agricultural pesticides. Of the remaining, 9 were authorized for domestic purpose. Highest detection of agricultural-exclusive pesticides (47%) was in the homes near vineyards. Older dust samples are still under analysis. Conclusion: Our results confirmed previous studies in US assessing the household pesticides contamination from surrounding fields. However, our findings indicate non-agricultural use contributes substantially to the total contamination observed in our study homes.

Abstract Number	**O-4-24-01**
Presenter	Elisa Bandera*, Urmila Chandran, Brian Buckley, Min Liu, Anousheh Mirabedi, Gayle Windham, Lawrence H Kushi
Exposure	food
Health domains	other
Type of research	exposure measurement

Free and total levels of estrogenic mycotoxins in girls in California and New Jersey

Background: There is a growing interest in the role of zearalenone (ZEA) and zeranol on puberty and breast cancer because of ample experimental evidence shows they act as endocrine disruptors. ZEA is a mycotoxin produced by fungal contamination of grains and other food products. Its metabolite, zeranol is commonly used in cattle to increase meat production in the US, although banned from other countries. Little is known about the metabolism and health effects of these compounds in humans. In pigs, ZEA is rapidly absorbed after ingestion and conjugated with glucuronic acid before it is excreted in urine. Therefore, most of the ZEA metabolites should be in conjugated form in urine, but the conjugated fraction in girls is unknown. Aims: To measure ZEA mycotoxins in two areas of the US to determine detectability and conjugated fraction in girls. Methods: We measured urinary free and total (free + conjugated) ZEA mycotoxins in 20 girls in the Jersey Girl Study (age 9-10 y), based in NJ, and 20 girls from the CYGNET Study (age 7-8 y), based in the San Francisco Bay Area, CA. We corrected values for specific gravity to adjust for urinary concentration. Results: Conjugated fractions were above 90% for ZEA and zeranol. Total ZEA was detected in all samples in both populations, with median values of 15,917 pg/ml in CA and 5,325 pg/ml in NJ. Free ZEA was detected in 79% of the CA samples (median: 439 pg/ml) and 40% of the NJ samples (median: 0, mean: 38 pg/ml). Total zeranol was present in 79% of the CA samples (median: 2,392 pg/ml) and 50% of the NJ samples (median: 42 pg/ml), while free zeranol was detected only in CA and levels were low. Conclusions. Total ZEA and related metabolites were present in all the samples in both populations, mostly in conjugated form, with levels for all compounds considerably higher in CA than in NJ. Further studies are critically needed to evaluate the health effects of these widely-detected estrogenic mycotoxins in peripubertal girls.

Abstract Number	**O-4-24-02**
Presenter	Rey Decastro*, Kathleen Caldwell, Robert Jones, Benjamin Blount, Yi Pan, Cynthia Ward, Mary Mortensen
Exposure	food
Health domains	other
Type of research	cross-sectional study

Association of Urinary Arsenic Species with Diet in a Representative Sample of the United States Population 2003 – 2010

BACKGROUND: Arsenic is an ubiquitous environmental element linked to carcinogenicity, neurotoxicity, as well as adverse respiratory, gastrointestinal, hepatic, and dermal health effects. AIMS: Identify dietary sources of arsenic in urine [nmol/L] for As(III), As(V), monomethylarsonic acid (MMA), and dimethylarsinic acid (DMA) species. METHODS: Age-stratified, sample-weighted statistical analysis of National Health and Nutrition Examination Survey (NHANES) 2003 – 2010 data (approx. 8,600 participants) characterized the association between urinary arsenic species and the mass consumed in USDA-standardized food groups, controlling for urinary creatinine and other potential confounders. RESULTS: For all arsenic species, the rank-order for age strata was children 6 – 11 YO > adults 20 – 84 YO > adolescents 12 – 19 YO, and for all age strata, the rank-order for urinary concentration was DMA > MMA > As(V) > As(III). The three largest significant increases (where available) in urinary concentration in each age strata were associated with consumption of fish, rice, and rice cakes/crackers for As(III) (range: 0.76 – 15.71 nmol/L per kg consumed); fish, rice, rice beverage/milk, and rice cakes/crackers for DMA (59.83 – 827.60); eggs, fruits, rice, rice beverage/milk, and rice cakes/crackers for MMA (1.44 – 110.16). No food group was significantly associated with increased urinary As(V). Consumption of food at median and 90th percentile rates, however, highlighted exposure from eggs, fish, fruits, grain products, legumes, nuts, seeds, meat, poultry, and sugars, sweets, beverages. CONCLUSIONS: In a nationally representative sample of the United States, certain food groups were associated with increased exposure to arsenic species, depending on age and food consumption rates.

Abstract Number	**O-4-24-03**
Presenter	Chensheng Lu*, Mei Chen, Erin Collins, Lin Tao
Exposure	food
Health domains	neurodevelopment
Type of research	exposure measurement

Quantitative Analysis of Neonicotinoid Insecticides in Foods– Implications of Dietary Intakes in Children

Background The neonicotinoids are a class of systemic insecticides that are widely used in agriculture, veterinary medicine, and residential environment in U.S. and worldwide. With similar chemical structures to nicotine, neonicotinoids also share agonistic activity at neuronal nicotinic acetylcholine receptors (nAChRs). It has been reported that nAChRs are expressed by the first trimester in human brain and exhibit a complex pattern of developmental expression that is both region-specific and temporally regulated, and in many brain areas there is a transient appearance of nAChRs during critical phases of development. Unlike OP or pyrethroids, there is very little data on human exposure to neonicotinoids and the health effects of chronic neonicotinoids exposure from dietary intake. Methods We analyzed fresh fruits and vegetables randomly purchased from local supermarkets that are commonly consumed by young children. We utilized a liquid chromatography-tandem mass spectrometry (LC-MS/MS) method to simultaneously quantify 8 neonicotinoids, including acetamiprid, clothianidin, dinotefuran, flonicamid, imidacloprid, nitenpyram, thiacloprid and thiamethoxam in those food samples. Results We found approximately 60% of fresh produce samples contained imidacloprid, one of the most commonly used neonicotinoids, with levels ranging from 0.1 to 7.2 µg/kg. This is consistent to data reported by the USDA's Pesticide Data Program (PDP) in which the frequency of detection for imidacloprid ranged from 94% in 2008 to 22% in 2010. Conclusions Foods that are frequently detected with imidacloprid and other neonicotinoids are also commonly consumed by children, such as watermelons, grapes, apples, and apple juices. Because of the importance of nAChRs for mammalian brain function, especially during critical phases of brain development, detailed epidemiological investigation of the chronic toxicities at the low levels of neonicotinoids is warranted from the public health perspectives.

Abstract Number	**O-4-24-04**
Presenter	David Miller*
Exposure	food
Health domains	no health domain
Type of research	exposure modeling

Food Commodity Consumption Data and New Tools used by US EPA's Office of Pesticide Programs

The US EPA's Office of Pesticide Programs (OPP) conducts its dietary assessments for pesticides by combining data on pesticide concentrations on food commodities (e.g., apples) with data on consumption of these commodities. This consumption data has in the past been derived from the USDA's Continuing Survey of Food Intakes by Individuals (CSFII). CSFII was replaced by the USDA's "What We Eat in America" (WWEIA) survey in 1999, and is now conducted as part of the US' National Health and Nutrition Examination Survey (NHANES). OPP recently shifted from CSFII to the WWEIA survey and now routinely uses data from this more recent survey in its dietary assessments. In order to conduct these assessments, EPA has converted the foods reported "as eaten" in the WWEIA survey (e.g., lasagna) to their component ingredients (e.g, wheat flour, tomato, etc.) by means of recipe files developed for this purpose. The dietary consumption data used by OPP is public information, and public availability has been recently enhanced: specifically, a collaborative effort between the University of Maryland/US FDA's Joint Institute for Food Safety and Applied Nutrition (JIFSAN) and OPP has placed the data files on food commodity consumption and several web applications tools developed by JIFSAN on the web (http://fcid.foodrisk.org). These tools considerably increase the availability and transparency of the data used in dietary risk assessment and permit the public to perform simple queries of the data. The presentation will cover the EPA's Food Commodity Intake Database and its contents; the JIFSAN recipe search tool which permits the user to search (or reverse search) recipes; and the JIFSAN consumption calculator which enables customized analysis of WWEIA-FCID 2003-08. The results of some illustrative analysis of the data using these tools will also be demonstrated. Together, the data and tools provided open up to the public a wide range of information that is useful for exposure assessment and considerably eases its use and interpretation.

Abstract Number	**O-4-24-05**
Presenter	Cian O' Mahony*
Exposure	food
Health domains	other
Type of research	exposure modeling

A Probabilistic Exposure Model for Food Packaging Migrants

Background: Estimating the dietary dose to contaminants from food packaging in a population requires a number of inputs. The concentration of migrant in food must be known, together with the level of consumption of the food. In order to assess total aggregate dose to the packaging migrant, this must be known for all combinations of food and food packaging, together with the variability in the dietary intake of the foods in the population of interest. Aims: To develop databases, models and software to estimate consumer exposure to food packaging migrants. Methods: 15 dietary surveys from 8 member states were recoded into a harmonised food categorisation system for food packaging. Market study data on the distribution of pack types in the EU was recoded into the same harmonised system, which was in turn linked to food packaging data provided by industry. The composition of the packaging raw materials as well as their arrangement in packaging structures was also included. A probabilistic diffusion model and related physicochemical parameters was developed to assess the concentration of migrants in foods to generate a database of migrant concentrations in foods. This is turn can be linked to a probabilistic dietary exposure model based on food consumption. Results: The developed databases and models were integrated into a desktop software system. Options in an exposure assessment include assessing specific food types, specific packaging types, and specific consumer demographics. A distribution of exposure per unit body weight is generated. Exposure in population can be broken down by food category for a specific packaging type or conversely broken by packaging type for a specific food category or total diet. Significance: The software tool presents a rational and realistic methodology for assessing dietary exposure to food packaging migrants. This work was funded by the EU Seventh Framework Programme (FP7).

Abstract Number	**O-4-24-06**
Presenter	Jutta Lindert*
Exposure	others
Health domains	ethics
Type of research	review

Linkages between agriculture, environment and diseases of poverty (e*)

The literature has been consistent about linkages between human-induced changes in the environment, social factors, and primarily the poverty related diseases (PRDs). In particular, agriculture and environmental changes (e.g., disruptions to the nitrogen cycle, to ecosystems, biodiversity, and to land-use), and global and regional social inequalities (e.g., increases in food prices) have been identified as specific factors exacerbating diseases of poverty. PRDs are often co-morbid with malnutrition. When food prices rise, poor populations preserve calorie intake at the expense of nutrients, increasing their vulnerability to other diseases and reducing their immunity. Together, PRDs kill approximately 14 million people annually. The European Union, especially the Directorate General for Health and Consumer Protection (DG-SANCO) has been occupied with the protection of consumers within the European Union. DG -SANCO aims to improve the health of the population within member states by identifying, monitoring, and targeting health risks for consumers. However, in many countries, the lack of protection, agricultural activities, and human-induced environmental changes present enormous challenges for Public Health, especially for the most vulnerable groups of the population such as children, women, and marginalised groups. There is insufficient knowledge and understanding of systemic factors such as human-induced environmental changes and social factors that promote PRDs, resulting in ethical challenges of a particular type. For instance, what tools for monitoring diseases of poverty are available to improve population health? Are opportunities for environmental epidemiologists to protect population health used effectively and even adequately? What kind of multi-disciplinary work is needed to better address human-induced environmental changes and social factors in a systemic way? We will address these matters in a designated ethics discussion session on ethical challenges on the linkages between agriculture, environment, and diseases of poverty.

Abstract Number	**O-4-25-01**
Presenter	Meytar Sorek-Hamer, Anthony Strawa, Robert Chatfield, Robert Esswein, Petros Koutrakis, Ayala Cohen, David M. Broday*
Exposure	ambient air pollution
Health domains	other
Type of research	exposure modeling

Comparative performance of Four Statistical Models for predicting PM2.5 from Satellite Data

Ambient particulate matter (PM) is derived from diverse sources, natural and anthropogenic. PM is usually characterized by its size and chemical composition, which may affect its health effects. Recent studies revealed significant associations between fine particles (diameter<2.5mm) and human health, based on standard ground monitoring data. A global observation from space can give an answer to some ground monitoring limitations, since satellite imagery allows environmental mapping at a large spatial scale. Following a careful literature review on the use of satellite data for air quality management, we propose to study whether it is possible to utilize satellite observation data for assessing exposure to fine particles in Israel and in San Joaquin Valley (CA, USA). Use of satellite observations may provide PM2.5 mapping, that nowadays is based merely on measurements from surface stations, in areas where ground monitoring does not exist or is sparse. Four statistical methods for retrieving PM2.5 concentrations from satellite variables over the San Joaquin Valley (CA, USA) and Israel are compared – linear regression (LR), generalized additive model (GAM), multivariate adaptive regression spline (MARS), and mixed effects model (MEM). The simple LR showed poor correlations in both Israel and the western US (R2~0.2). Both GAM and MARS were found to perform better than the simple LR (R2~0.7), and the daily calibrated MEM ,using only one satellite-based variable – AOD (Aerosol optical depth) showed the best results (R2~0.85). Improved PM2.5 retrievals can fill in missing surface measurements and be used to estimate reliably exposure to fine PM for public health applications and environmental health studies.

Abstract Number	**O-4-25-02**
Presenter	Denise Montagne*, Gerard Hoek, Mark J Nieuwenhuijsen, Timo Lanki, Meritxell Portella, Arto Pennanen, Marloes Eeftens, Tarja Yli-Tuomi, Marta Cirach Pradas, Bert Brunekreef
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

The association of LUR models for the elemental composition of PM2.5 with personal exposure

Background and aims Land use regression (LUR) models predict spatial variation of ambient concentrations, but little is known about the validity of predicting personal exposures. In this study, the association of LUR modeled concentrations of PM2.5 components with measured personal concentrations was determined. The elements of interest were copper (Cu), Zinc (Zn), iron (Fe), potassium (K), nickel (Ni), vanadium (V), silicon (Si) and sulfur (S). Methods In Helsinki, Utrecht and Barcelona five participants from urban background, five from semi-urban background and five from busy street sites were selected (15 participants per city). Outdoor, indoor and personal PM2.5 samples were collected by the participants for two weeks in three different seasons (winter, summer and spring/autumn). Per 96 hour measuring period, measurements were conducted by three participants (one from every site type). Elemental composition was measured by XRF. The LUR models for the ambient concentrations of each element were developed by the ESCAPE project. Results LUR models predicted only Cu and Fe within-city variation of outdoor concentrations well (range in R2 27-67% for Cu and 24-54% for Fe) LUR models significantly correlated with measured personal Fe exposure in Utrecht, but not in Barcelona and Helsinki. LUR models did not correlate with measured personal Cu exposure. The LUR models were well correlated with measured outdoor, indoor and personal exposures when the data for the three cities was pooled for all elements. Conclusions The best models for ambient concentrations were found for Fe and Cu, components for which traffic is an important source. Within-city modeled variation did not predict variation in personal exposure well.

Abstract Number	**O-4-25-04**
Presenter	Kazuhiko Ito*, Iyad Kheirbek, Sarah Johnson, Grant Pezeshki, Zev Ross, Holger Eisl, Thomas Matte
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Spatial variation of fine particle vanadium and ship emissions in New York City

Background: Epidemiological studies have reported associations between fine particles (PM2.5) and various health outcomes. Chemical constituents of PM2.5 may play roles in these associations, but most chemical speciation data do not provide sufficient spatial resolution to depict intra-urban variation. Aims: To characterize spatial variation of PM2.5 chemical constituents in New York City using data from New York City Community Air Survey (NYCCAS). Methods: PM2.5 filters from 150 NYCCAS sites (each site sampled for two-weeks in each season) in the first year, Dec. 2008 – Nov. 2009, were analyzed by X-ray fluorescence method. Of 51 elements measured, we retained 16 elements with sufficient signals for data analysis (in elemental symbol): Na, Al, Si, S, Cl, K, Ca, Ti, V, Mn, Fe, Ni, Cu, Zn, Br, Pb. The two-week measurements were temporally adjusted using PM2.5 mass concentrations from separate reference sites before computing annual average at each site. We conducted a hybrid factor analysis in which emission/land-use indicators for traffic, residual oil burning, tree/grass cover, marine vessels, and industrial emissions were included along with the 16 elements, black carbon (BC), nitrogen dioxide (NO2), and sulfur dioxide. Results: Factor analysis identified factors associated with residual oil burning (Ni, SO2), traffic (BC, NO2, Cu), and soil (Al, Si), all of which also showed some weaker associations with other elements, suggesting spatial overlap of sources. The most unambiguous factor was the one associated with the indicator for marine vessels (inverse distance to navigation paths weighted by associated berth volumes) and V, with only minor correlation with S and BC and not with Ni. Conclusions: The estimated impact of emissions from marine vessel activity explains the spatial variation of vanadium in New York City. The indicator's lack of correlation with Ni suggests that vanadium is, at least spatially, a good indicator of ship-related emissions.

Abstract Number	**O-4-25-05**
Presenter	Xinxin Zhai, Cesunica Ivey, Sheila Sororian, Mariel Friberg, Heather Holmes, Yongtao Hu, Armistead Russell*, James Mulholland, Howard Chang, Matthew Stirckland, Wenxian Zhang
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Spatially-Resolved Source Impact Estimates for Air Quality Health Risk Assessment

Background: The relationship between geo-coded patient information and ambient air quality is being investigated over Georgia. The monitor-observed and model-predicted ambient concentrations are combined with data fusion techniques to provide spatially-resolved source impact estimates. Objective: To develop data fusion techniques for spatially-resolved species concentrations and source impact estimates for use in health studies. Methods: Indicator: Data fusion techniques combine chemical transport model (CMAQ, 4 km resolution) results with observed species concentrations through obtaining a scaling factor which is spatially interpolated by kriging. The fused spatially-resolved metrics of EC, CO, and NOx are applied to an emission-based Integrated Mobile Source Indicators method for estimating mobile source impact fields. Hybrid-Kriging (HK): The HK model approach adjusts the CMAQ source impact estimates based on source impact scaling factors obtained using simulations and observations in a CMB-based optimization. This factor is spatially interpolated by kriging, and then applied to the original CMAQ source impact field to adjust source impact estimates over the CMAQ domain. Receptor Model: Chemical Mass Balance (CMB) and Positive Matrix Factorization (PMF) receptor-based source apportionment models, using observed PM2.5 species concentrations from spatially-distributed monitors estimate source impacts at each location. Results: Source impact estimates from the methods are compared with each other and with emissions inventory estimates in the state of Georgia, showing significant differences. Conclusion: Spatially-resolved source impact estimates across Georgia allow for the spatial analysis of health data to assess pollutant exposure risks of susceptible and vulnerable populations. These estimates link the health associations to sources, which is needed for effective policy development. Quantifying variation in source impacts estimated using different methods provides enhanced estimates of uncertainty since source impacts cannot be measured directly.

Abstract Number	**O-4-25-06**
Presenter	Hassan Amini*, Seyed Mahmood Taghavi Shahri, Sarah B. Henderson, Kazem Naddafi, Ramin Nabizadeh, Masud Yunesian
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Estimating seasonal and spatial variability of particulate matter and sulfur dioxide concentrations by land use regression in Tehran, Iran

Background: The air quality in Tehran, Iran is poor compared with the cities in North America and Europe where land use regression (LUR) has been most frequently applied. Aims: We aimed to estimate seasonal and spatial variations of PM10 and SO2 pollutants in Tehran, Iran using LUR. Methods: The response variable data (SO2 and PM10) were obtained from 21 governmental automatic air pollution monitoring stations distributed across the metropolitan area of Tehran. A group of 210 potentially predictive variables was created within a Geographic Information System, including several variables that have not been used in other studies, and new variable types. A novel step-by-step algorithm for LUR model building was developed to select variables based on (a) consistency with the a priori assumptions about the assumed direction of the effect for each variable, (b) improvements to the leave-one-out cross-validation (LOOCV) R2, and (c) a multicollinearity index called variance inflation factor. Results: The annual average concentrations of PM10 and SO2 across the stations were 100.8 µg/m3 and 38 ppb, respectively. The LOOCV R2 values for the LUR models ranged from 0.52 to 0.71 for PM10 and from 0.62 to 0.73 for SO2. Although there was limited similarity between the PM10 and SO2 predictive variables, measures of bridge presence and bridge proximity were consistent across both pollutants. Conclusions: Resulting models and maps show that patterns were consistent throughout the year for PM10, but there were clear differences between the warmer and cooler seasons for SO2.

Abstract Number	**O-4-26-01**
Presenter	Ami Zota*, Linda Linderholm, June-Soo Park, Tan Guo, Myrto Petreas, R. Thomas Zoeller, Martin Privalsky, Darcy Tarrant, Tracey Woodruff
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cross-sectional study

A comparison of PBDEs, PCBs, OH-PBDEs, and OH-PCB concentrations in paired human samples of maternal serum and fetal liver during mid-gestation

Background. Prenatal exposure to polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyl ethers (PCBs) may disrupt fetal development. However, little is known about human fetal exposures or the ability of the fetus to metabolize PBDEs or PCBs during mid-gestation. Aim. To characterize human fetal exposures to PBDEs, PCBs, and their metabolites during 2nd trimester of pregnancy. Methods. We collected maternal serum and fetal liver samples from 36 patients having a voluntary pregnancy termination in San Francisco, California. PBDEs and PCBs, and their hydroxylated metabolites (OH-PBDEs and OH-PCBs) were measured by GC/HRMS and GC/LRMS, respectively. Results. PBDEs and PCBs were detected in all samples. Maternal serum and fetal liver concentrations were highly correlated (Spearman rho > 0.60; $p < 0.05$). PBDE and PCB concentrations (ng/ml) were higher in fetal liver compared to maternal serum (median fetal liver: maternal serum ratio = 1.8), but after lipid adjustment, the median fetal liver: maternal serum ratio = 0.4. For OH-PBDEs, fetal liver concentrations were higher than maternal serum in 40% of participants. In multivariate regression models, fetal liver levels of 5-OH-BDE-47 (BDE-47 metabolite) were positively associated with maternal serum levels of 5-OH-BDE-47, fetal liver levels of BDE-47, and gestational age (model R2 = 0.60). Similar relationships were found between fetal liver levels of 5-OH-BDE-99 and BDE-99. OH-PCBs were rarely detected in fetal liver samples. Conclusions. This is the first human study to examine concentrations of PBDEs, PCBs, and their metabolites in paired samples of maternal serum and fetal liver during mid-gestation. Our data suggests that PBDEs and PCBs cross the placenta and accumulate in the fetal liver, likely because of the organ's high lipid content. PBDE-47 and -99 may be metabolized to OH-PBDEs in the fetal liver. These results will be informed by our ongoing analysis of gene expression of CYP enzymes in fetal liver samples.

Abstract Number	**O-4-26-02**
Presenter	Eva Morales*, Mireia Gascón, David Martínez, Maribel Casas, Ferran Ballester, Clara L. Rodríguez-Bernal, Jesús Ibarlucea, Loreto Santa Marina, Esther Vizcaino, Joan O. Grimalt, Jordi Sunyer
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Associations between blood persistent organic pollutants and 25-hydroxyvitamin D3 in pregnancy

Background. Persistent organic pollutants (POPs) are suggested to contribute to lower vitamin D levels; however, studies in humans are scarce and have never focused on pregnancy, a susceptibility period for vitamin D deficiency. Aim. To investigate whether serum levels of POPs were associated with circulating 25-hydroxyvitamin D3 [25(OH)D3] concentration in pregnancy. Methods. Cross-sectional associations of serum concentrations of eight POPs with plasma 25(OH)D3 concentration were analyzed in 2031 pregnant women participating in the Spanish population-based cohort INfancia y Medio Ambiente (INMA) Project. Serum concentrations of POPs were measured by gas chromatography andplasma 25(OH)D3 concentration was measured by high-performance liquid chromatography in pregnancy (mean 13.3±1.5 weeks of gestation). Multivariable regression models were performed to assess the relationship between blood concentrations of POPs and 25(OH)D3. Results. After adjustment, higher PCB180 levels were associated with lower 25(OH)D3 concentration: quartile Q4 vs. quartile Q1, coefficient= -1.59, 95% CI -3.27, 0.08, p trend=0.060. A non-monotonic inverse relationship was found between the sum of predominant PCB congeners (PCB 180, 153 and 138) and 25(OH)D3 concentration: coefficient (95% CI) for quartile Q2 vs. Q1 [-0.50 (-1.94, 0.94)], quartile Q3 vs. Q1 [-1.56 (-3.11, -0.02)] and quartile Q4 vs. Q1 [-1.21 (-2.80, 0.38)], p trend=0.081. No significant associations were found between circulating 25(OH)D3 and serum levels of p,p'-DDE, p,p'-DDT, HCB and ß-HCH. Conclusions. Background exposure to PCBs may result in lower 25(OH)D3 concentration in pregnancy. Chemical exposure to POPs as a possible cause of vitamin D deficiency in pregnancy should be considered in future studies. If associations reported here were confirmed, efforts to reduce body burden of POPs in pregnant women may be helpful to increase vitamin D levels and prevent vitamin D deficiency-related pregnancy and offspring outcomes.

Abstract Number	**O-4-26-03**
Presenter	Tony Fletcher*, Debapriya Mondal, Rosana Weldon, Brenda Eskenazi
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	exposure measurement

Serum levels of perfluoroalkyl acids in mothers and infants: transplacental and lactational transfer from the mother

Objectives: The aim of the present study is to investigate the impact of pregnancy and breast-feeding on maternal and infant serum PFAA concentrations among residents of the mid-Ohio Valley. Women were exposed to PFOA from industrial emissions and participated in the C8 Study in 2005-6, which included serum measurements of PFOA. Methods: We compared serum PFOA concentrations of 404 women who were pregnant at survey, adjusted for age, water district and parity, with 4484 women of similar age range (18-35) not pregnant within 3.5 years. For 633 women who had given birth within 42 months of the survey along with 8%(n=49) of the infants, we regressed serum PFOA concentrations on reported duration of breast-feeding compared to the non breast feeders, adjusting for maternal and child age and water district. Results: Attributable to pregnancy, we observed decreases in serum PFOA in pregnant compared to non-pregnant women: 19% decrease (95%CI: 5%, 30%) for the first trimester and 23% (11%, 33%) for the third. For PFOS, decreases were not statistically significant. Due to lactation, we observed 34% (23%, 44%) and 26% (16%, 34%) decreases in maternal PFOA and PFOS levels, respectively, per 12 months breastfeeding and a stronger decreased effect of 60% (27%, 78%) for women with past, but not on-going, exposure to PFOA above background level. For infants, serum levels in bottle-fed infants were similar to their mothers, but breastfeeding increased children's serum PFOA concentrations 2.0-fold (1.0, 3.0) and for PFOS 2.2-fold (1.4, 3.4). Conclusions: This study suggests that pregnancy and lactation significantly impact serum levels of PFAAs and in utero and lactational transfer are important exposure routes to infants. Further, breastfeeding practice and duration should be considered when estimating in utero levels from serum measurements taken postnatally.

Abstract Number	**O-4-26-04**
Presenter	David Savitz*, Gregory A. Wellenius, Mark Klebanoff, Elizabeth Jensen, Matthew Longnecker
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Persistent Organochlorines and Hypertensive Disorders of Pregnancy

Background Hypertensive disorders of pregnancy, particularly preeclampsia, can result in serious harm to the fetus and mother. Little research has considered the role of environmental toxicants in the etiology of preeclampsia, but pathways related to oxidative stress, inflammation, and lipid metabolism may be relevant. Aims We examined the relationship between serum levels of persistent organchlorines, including the DDT metabolite DDE, polychlorinated biphenyls (PCBs), and related compounds and the development of gestational hypertension and preeclampsia. Methods Data from the Collaborative Perinatal Project, a large US birth cohort study conducted in the 1960s, with markedly higher exposures than at present, were analyzed. 2,193 women, selected for a previous study had measured third trimester serum organochlorine values (lipid-adjusted) as well as detailed information on blood pressure and proteinuria. There were 211 women with gestational hypertension and 109 with preeclampsia. Results Logistic regression yielded an inverse association between exposure measures and outcome, with adjusted odds ratios in the uppermost quintile for DDE of 0.7 (95% CI=0.4-1.3) and 0.4 (95% CI=0.1-0.9) for gestational hypertension and preeclampsia with p-values for linear trend of 0.29 and 0.02, respectively. The pattern for total PCBs was as or more notable, with adjusted odds ratios in the uppermost quintile of 0.6 (95% CI=0.3-1.1) and 0.2 (95% CI=0.04-0.8), for gestational hypertension and preeclampsia, with p-values for linear trend of 0.08 and 0.04, respectively. Other organochlorines showed inverse associations that were less pronounced or consistent. Conclusions There is strong support for an inverse association for both DDE and PCBs and hypertensive disorders of pregnancy. Artifacts related to shared determinants of exposure biomarkers and outcome such as renal dysfunction and dyslipidemia may account for the associations.

Abstract Number	**O-4-26-05**
Presenter	Kelly K. Ferguson*, Bhramar Mukherjee, Thomas McElrath, John D. Meeker
Exposure	others
Health domains	other
Type of research	cohort study

Associations between urinary phthalate metabolites and biomarkers of inflammation and oxidative stress in pregnant women

Background: Phthalate exposure is prevalent and associated with an array of adverse health effects. We hypothesized that these relationships may be mediated by phthalate-induced increases in systemic levels of inflammation and oxidative stress. In this study we examine the relationship between phthalate exposure and changes in biomarkers of inflammation and oxidative stress during pregnancy. Methods: Pregnant women recruited in the first trimester provided urine and plasma samples at medians of 10, 18, and 26 weeks gestation. C-reactive protein (CRP) and cytokines IL- 1β, IL-6, IL-10, and TNF-α were measured in plasma as markers of inflammation, and 8-hydroxydeoxyguanosine (8-OHdG) and 8-isoprostane (8-Iso) in urine were markers of oxidative stress. As an indicator of exposure, phthalate metabolites were measured in urine samples and levels were averaged across pregnancy. Results: Crude analysis between biomarkers and phthalate levels standardized for specific gravity showed significant positive correlations between CRP and mono-benzylbutyl phthalate (MBzP), mono-butyl phthalate (MBP), and mono-ethyl phthalate (MEP). Correlations were stronger with oxidative stress biomarkers for the same metabolites as well as mono-isobutyl phthalate (MiBP) and mono-carboxypropyl phthalate (MCPP). In models adjusting for specific gravity, maternal age, race/ethnicity, and education level associations with CRP and MBzP remained significant. Relationships between oxidative stress markers and MBzP, MBP, MiBP, MEP, and MCPP retained significance as well. Associations between phthalate metabolites and cytokines were spurious in both crude and adjusted analyses. Conclusions: Markers of inflammation (CRP) and oxidative stress (8-OHdG and 8-Iso) are associated with urinary phthalate metabolites in pregnant women which has relevance for understanding phthalate relationships with reproductive outcomes.

Abstract Number	**O-4-27-01**
Presenter	Bianca Cox, Evelyne Martens, Benoit Nemery, Vangronsveld Jaco, Tim S. Nawrot*
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	others

Impact of a stepwise introduction of smoke-free legislation on the rate of preterm births: analysis of routinely collected birth data

In Belgium, smoke-free legislation was implemented in different phases. The first phase, implemented on 1 January 2006, required all public places and workplaces to be smoke-free. The legislative ban on smoking in restaurants was introduced on 1 January 2007, while for bars serving food, smoke-free legislation was implemented on 1 January 2010. These successive steps in legislation gave us the opportunity to investigate possible stepwise changes in preterm delivery. To investigate the incidence of preterm delivery in the Belgian population after the three steps implementation of smoke-free legislation. Logistic regression analyses was used. We found reductions in the risk of preterm birth after the introduction of each phase of the smoking ban. No decreasing trend was evident in the years or months before the bans. We observed a step change in the risk of spontaneous preterm delivery of −3.13% (95% CI −4.37% to −1.87%; P<0.01) on 1 January 2007 (ban on smoking in restaurants), and an annual slope change of −2.65% (−5.11% to −0.13%; P=0.04) after 1 January 2010 (ban on smoking in bars serving food). The analysis for all births gave similar results: a step change of −3.18% (−5.38% to −0.94%; P<0.01) on 1 January 2007, and an annual slope change of −3.50% (−6.35% to −0.57%; P=0.02) after 1 January 2010. These changes could not be explained by personal factors (infant sex, maternal age, parity, socioeconomic status, national origin, level of urbanisation); time related factors (underlying trends, month of the year, day of the week); or population related factors (public holidays, influenza epidemics, and short term changes in apparent temperature and particulate air pollution). Our study shows a consistent pattern of reduction in the risk of preterm delivery with successive population interventions to restrict smoking. This finding is not definitive but it supports the notion that smoking bans have public health benefits from early life.

Abstract Number	**O-4-27-02**
Presenter	Sarah Rajkumar*, Cong Khanh Huynh, Georg Bauer, Daiana Stolz, Alexander Möller, Jürg Hammer, Gregory A. Wellenius, Arno Schmidt-Trucksäss, Martin Röösli
Exposure	others
Health domains	cardiovascular disease
Type of research	cohort study

THE EFFECT OF A SMOKING BAN INTRODUCTION ON EXPOSURE AND CARDIO-RESPIRATORY HEALTH IN SWISS HOSPITALITY WORKERS

Background and Aims: In May 2010 Switzerland introduced a heterogeneous smoking ban in the hospitality sector. To evaluate the effect on workers' health, personal exposure and markers of cardio-respiratory health were measured repeatedly in 92 non-smoking hospitality workers. Methods: Second-hand smoke (SHS) exposure was determined using nicotine specific badges and expressed as inhaled cigarette equivalents per day (ce/d). Heart rate variability (HRV), a quantitative marker of autonomic activity of the nervous system, and pulse wave velocity (PWV), a marker of arterial stiffness, were measured in 55 non-smoking hospitality workers before and after implementation of a smoking ban. Fractional exhaled Nitric Oxide (FeNO), a marker of airway inflammation, and pulmonary function were also assessed. 37 non-smokers were included in a control group that did not experience any change in exposure. Results: The smoking ban was associated with significantly lower SHS exposure among hospitality workers (2.56 (95% CI: 1.70 to 3.44) ce/d before the ban vs 0.16 (95% CI: 0.13 to 0.20) ce/d after the ban. The ban was also associated with a 2.3% (95% CI: 0.2 to 4.4; p=0.031) increase in RMSSD, a measure of the high frequency content of HRV per decrease in ce/d and a 15.1% (95% CI: 8.1 to 22.2; p<0.001) decrease in PWV. Similar associations were not observed in the control group. FeNO levels decreased in the intervention group after the ban, compared to the control group (p<0.001). Lung function parameters were below average at the beginning of the study and did not change in any group. Conclusions: Within a year after the smoking ban, non-smoking hospitality workers showed significant reductions in risk factors for myocardial infarction and arteriosclerosis. Markers of airway inflammation decreased as well. Lung function damage may take longer to recover or may be irreversible. These results support a positive effect of a smoking ban, mainly on cardiovascular health.

Abstract Number	**O-4-27-03**
Presenter	Esther Garcia-Esquinas*, Lauren F. Loeffler, Virginia M. Weaver, Jeffrey J. Fadrowski, Ana Navas-Acien
Exposure	others
Health domains	other
Type of research	cross-sectional study

Kidney function and tobacco smoke exposure in US adolescents

Introduction: There is evidence that active smoking and secondhand smoke are risk factors for chronic kidney disease in adults. However, no data are available for children. The main objective was to evaluate the association between exposure to active smoking or secondhand smoke and kidney function in US adolescents. Methods: Cross-sectional study in 7,516 adolescents aged 12 to 17 who participated in NHANES 1999-2010 and had serum creatinine and cotinine measures. Active smoking was defined as self-reported smoking or serum cotinine concentrations >10 ng/mL. Secondhand smoke was defined as non-active smokers who self-reported living with ≥1 smokers or serum cotinine concentrations ≥0.05 ng/mL. Kidney function was determined using the CKiD glomerular filtration rate estimating (eGFR) equation. Results: Median (interquartilic range) eGFR and serum cotinine concentrations were 96.8 (85.4-109.0) mL/min per 1.73 m2 and 0.07 (0.03-0.59) ng/mL, respectively. After multivariable adjustment, eGFR decreased 1.1 mL/min per 1.73 m2 (95%CI: -1.8, -0.3) per IQR increase in serum cotinine concentrations. The mean (95%CI) difference in eGFR for serum cotinine tertiles 1, 2 and 3 among children exposed to secondhand smoke compared to unexposed were -0.4 (-1.9, 1.2); -0.9 (-2.7, 0.9) and -2.2 (-4.0, -0.4) mL/min per 1.73 m2, respectively (p-value for trend 0.03). The corresponding values among tertiles of active smokers compared to unexposed were0.2 (-2.2, 2.6), -1.9 (-3.8, 0.0) and -2.6 (-4.6, -0.6) mL/min per 1.73 m2 (p-value for trend 0.01). Conclusions: Our results support the possibility that tobacco smoke effects on kidney function begin in childhood.

Abstract Number	**O-4-27-04**
Presenter	Robert McConnell*, Ernest Shen, Frank Gilliland, Michael Jerrett, Jennifer Wolch, Chih-Chieh Chang, Frederick Lurmann, Kiros Berhane
Exposure	ambient air pollution
Health domains	obesity
Type of research	cohort study

Obesogenic Effects of Exposure to Tobacco Smoke and Air Pollution in Children

Background:Increased childhood body mass index (BMI) and obesity prevalence have been associated with exposure to tobacco smoke (secondhand smoke (SHS) and maternal smoking during pregnancy) and to vehicular air pollution. Aims: We examined the joint effects on BMI and obesity of air pollution and tobacco smoke, which could have potentially large public health impact because both are common exposures. Methods:Information on exposure to SHS and maternal smoking during pregnancy were collected from parents at the time of enrollment in 1993 and 1996 of a cohort of 3318 participants (mean age 10.1) into the Southern California Children's Health Study. Near-roadway pollution exposure (NRP) at each child's residence at study entry was modeled from a line source air dispersion model. The associations of exposure to tobacco smoke and NRP with BMI growth trajectory based on annual measurements and attained BMI at age 18 were assessed using a hierarchal statistical modeling framework. Results: SHS exposure was positively associated with the 8-year BMI growth (0.81 units; 95% confidence interval 0.35,1.26) and with attained BMI at age 18 (1.23 units; 0.85,1.60) compared with children without SHS exposure. Both BMI growth and attained level increased with more smokers in the home. Compared with children in homes with NRP below the median and no SHS exposure, attained BMI was greater among children in homes with high NRP and no SHS (0.65 units;0.17,1.13), with SHS and low NRP (0.84;0.40,1.28) and showed synergistic effects with both exposures (2.03;1.41,2.63), interaction P-value 0.002. A similar pattern of associations of BMI was observed with maternal smoking during pregnancy. Interpretation:The strong, synergistic associations of two combustion sources with BMI, and the unambiguous temporal relationship, strengthen emerging evidence that exposure to tobacco smoke and NRP both contribute to the development of childhood obesity.

Abstract Number	**O-4-27-05**
Presenter	Taina K. Lajunen*, Jouni Jaakkola, Maritta S. Jaakkola
Exposure	household air pollution
Health domains	respiratory disease
Type of research	case-control study

The Synergistic Effect of Heredity and Exposure to Second-hand Smoke on Adult-onset Asthma

Background: Identification of the part of the population especially susceptible to the adverse effects of second-hand smoke exposure (SHS) would be useful for preventive actions and interventions. There are no previous studies on the role of interaction between family history asthma and secondhand smoke exposure (SHS) for the development of adult-onset asthma. Objective: To investigate whether asthmatic heredity indicates susceptibility to the effects of SHS exposure on the risk of adult-onset asthma. Methods: A population-based incident case-control study of clinically defined adult-onset asthma and randomly drawn controls was conducted among adults 21 to 63 years old from a geographically defined area in South Finland. Altogether 521 cases and 1,016 controls participated (response rate 86% and 80%). After excluding current and ex-smokers there were 226 cases and 450 disease-free controls. Results: Parental asthma and recent SHS exposure had synergistic effect on the risk of adult-onset asthma, the adjusted odds ratio (AOR) being 1.97 (95% confidence interval (CI) 1.12-3.45) for SHS exposure, 2.64 (1.65-4.24) for parental asthma, and 12.69 (3.44-46.91) for their joint effect. Synergistic effect followed a dose dependent pattern with SHS: AOR 6.62 (95%CI 1.15-38.15) and 19.96 (2.31-172.80) for parental asthma and SHS of 1-9 and ≥10 cigarettes/day, respectively. Also siblings' asthma alone and parents and siblings' asthma combined showed synergism with recent SHS. Cumulative lifetime SHS also showed synergism with parental asthma. Conclusions: This is the first study showing that individuals with asthmatic heredity have a considerably increased risk of developing adult-onset asthma when exposed to SHS. Especially recent SHS exposure shows remarkable synergism with family history of asthma, and this is stronger with higher exposure levels. Avoiding SHS exposure could be an important preventive measure for reducing the risk of adult-onset asthma among those who have asthmatic heredity.

Abstract Number	**O-4-27-06**
Presenter	Maggie L. Clark*, Lesley M. Butler, Woon-Puay Koh, Renwei Wang, Jian-Min Yuan
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Effect modification by dietary fiber on the association between secondhand smoke and coronary heart disease mortality among Chinese nonsmokers in Singapore

Background: Secondhand smoke (SHS) exposure increases the risk of coronary heart disease (CHD) by an estimated 25-30% via oxidative stress and inflammatory mechanisms that may be ameliorated by dietary components. Aim: We evaluated the hypothesized modifying role of nutrients with known antioxidant and/or anti-inflammatory properties on the relationship between SHS exposure and CHD mortality. Methods: Detailed SHS exposure and dietary information was collected among 29,579 nonsmokers in the Singapore Chinese Health Study, a prospective population-based cohort. The evaluation of effect modification by dietary factors (β-cryptoxanthin, lutein, n-3 PUFAs, fiber, isothiocyanates, and soy isoflavones) was conducted within multivariable Cox proportional hazards models by creating an interaction term between the potential dietary effect modifier (lowest quartile of intake vs. the second through fourth quartiles of intake) and the SHS exposure (none vs. living with ≥1 smoker[s]). Results: Evidence for a main-effects association between SHS exposure and risk of CHD mortality was not observed. In stratified analyses by levels of selected dietary nutrient intake, fiber modified the effects of SHS exposure on risk of CHD mortality (P for interaction = 0.02). The adjusted hazards ratio for SHS exposure (living with ≥1 smoker[s] vs. living with no smokers) and CHD mortality was 1.62 (95% confidence interval: 1.00, 2.63) for those with low fiber intake. In contrast, among those with high fiber intake, there was no association with SHS exposure. Conclusion: We provide the first evidence that a diet high in fiber may ameliorate the harmful effects of SHS exposure on risk of CHD mortality.

Abstract Number	**O-4-28-01**
Presenter	Mette Sørensen*, Kim Overvad, Anne Tjønneland, Ole Raaschou-Nielsen
Exposure	noise
Health domains	cancer
Type of research	cohort study

Road traffic noise and risk for breast cancer

Background: Exposure to road traffic noise during night may cause sleep disturbances. Short sleep duration has been hypothesized to increase risk of breast cancer through melatonin suppression followed by increased estrogen production, increased tumor growth and reduced DNA repair. Some studies have indicated an inverse relationship between self-reported sleep duration and breast cancer risk, while other studies found no or even positive associations. Aim: To study if exposure to residential road traffic noise increases the risk of breast cancer. Methods: In a population-based Danish cohort of 29,875 women aged 50-64 years at enrollment in 1993–1997, we identified 876 incident, postmenopausal breast cancer cases during follow-up through 2006. Present and historical residential addresses from 1988 to 2006 were identified using a national register, and exposure to road traffic noise was estimated for all addresses. Associations between exposure to road traffic noise at diagnosis and breast cancer were analyzed in a Cox regression model, adjusted for HRT use, parity, alcohol and other potential confounders. We are currently extending follow-up until 2011, with estimation of noise at all addresses between 2007 and 2011 and inclusion of additional 400 breast cancer cases. When data are available (planned March 2013) we will reanalyze data and also investigate effects of long term exposure to road traffic noise (5 years) – these results will be presented at the ISEE conference in Basel. Results: Preliminary results on 876 cases show that a 10 dB higher exposure to road traffic noise (Lden) at diagnosis was associated with an incidence rate ratio (IRR) of 1.06 (95% CI: 0.96-1.16). In analyses according to estrogen receptor (ER) status, the IRR was 1.00 (95% CI: 0.90-1.12) among ER positive breast cancers (N=656) and 1.26 (95% CI: 1.01-1.58) among ER negative breast cancers (N=157). Conclusion: This first study on road traffic noise and breast cancer indicates that noise may increase the risk of ER negative breast cancer.

Abstract Number	**O-4-28-02**
Presenter	Maria Foraster*, Xavier Basagaña, Inmaculada Aguilera, Marcela Rivera, David Agis, Laura Bouso, Alexandre Deltell, Roberto Elosua, Nino Kuenzli
Exposure	noise
Health domains	cardiovascular disease
Type of research	cohort study

Disentangling the effects of traffic-related noise and air pollution on blood pressure: indoor noise levels and protections

Background In urban areas, traffic-related noise and air pollution may be correlated, thus effects mutually confounded. To disentangle effects, considering peoples' exposure indoors is essential. This has not been done so far which may explain inconsistent findings for blood pressure (BP) and hypertension (HT) and these two environmental stressors. We integrate for the first time indoor traffic noise to disentangle their effects. Aims We analysed associations of long-term exposure to home outdoor nitrogen dioxide (NO2) and outdoor and indoor estimates of traffic noise levels with HT, systolic BP (SBP), and diastolic BP (DBP; mmHg). Methods We evaluated 1926 participants at baseline (years 2003-2006) from the Catalan REGICOR cohort. We collected data on measures against noise at home indoors. Outdoor residential traffic noise at night (Lnight) and NO2 levels were estimated at façades with a city-specific noise model and land-use regression model, respectively. Individual indoor traffic noise levels were derived subtracting from outdoor noise the dB(A) reduction provided by reported noise protections, according to literature. Multivariate linear regression models were adjusted for NO2 and either outdoor or indoor noise. Results Median levels of home outdoor NO2 were 26.62µg/m3, of outdoor noise 55.96dB(A) and of indoor noise 46.11dB(A). Spearman correlations between outdoor and indoor noise with NO2 were 0.76 and 0.38, respectively. In the outdoor noise model, NO2 was associated only with BP and noise only with HT. In the indoor noise model, HT and BP showed more plausible patterns for both exposures (per IQR): NO2 (HT: OR=1.18, 95%CI: 0.98,1.42; SBP: β=1.60, 95%CI: 0.31,2.89; DBP: β=0.69, 95%CI:-0.9,1.46) and noise (HT: OR=1.06, 95%CI: 0.99,1.14, SBP: β=0.38, 95%CI: -0.1,0.87). Conclusion Our preliminary findings indicate that proper estimates of indoor noise exposure from outdoor sources are essential to investigate the independent effects of both traffic-related environmental stressors on HT and BP.

Abstract Number	**O-4-28-03**
Presenter	Ulrike Gehring*, Lillian Tamburic, Hind Sbihi, Hugh Davies, Michael Brauer
Exposure	noise
Health domains	reproductive outcomes
Type of research	cohort study

The impact of noise and air pollution exposure on pregnancy outcomes

Background: Motorized traffic is not only an important source of air pollution, but also an important source of community noise. While there is growing evidence for an adverse effect of ambient air pollution on pregnancy outcomes, little is known about the association between traffic noise and pregnancy outcomes. Aims: We investigated associations of small for gestational age (SGA), preterm birth, and term (low) birth weight (T(L)BW) with residential noise exposure in a population-based cohort study, for which we previously reported associations between air pollution and pregnancy outcomes and evaluated potential confounding of air pollution effects by noise and vice versa. Methods: With linked administrative health datasets and identified 68,238 singleton births (1999–2002) with complete covariate data (sex, ethnicity, parity, birth month and year, income, education) and maternal residential history in Vancouver, British Columbia, Canada. We estimated exposure to noise with a noise prediction model and exposure to air pollution using inverse-distance weighting of stationary monitors and temporally adjusted land use regression models for the entire pregnancy. Results: Noise exposure was positively associated with SGA and TLBW [adj. OR (95%CI) 1.10 (1.06-1.13) and 1.11 (1.02-1.19) per 6 dB(A)] and negatively associated with TBW [-19.1 (-22.9; -15.3) gram per 6 dB(A)]. In joint noise-air pollution models, noise and air pollution effects on SGA were found to be independent. Associations of TBW with noise remained largely unchanged in joint-effects models, whereas associations decreased for all air pollutants. Conclusion: Traffic may affect birth weight not only through air pollution but also through noise.

Abstract Number	**O-4-28-04**
Presenter	Danny Houthuijs*, Wim Swart, Caroline Ameling, Marten Marra, Oscar Breugelmans, Hanneke Kruize, Nicole Janssen, Paul Fischer
Exposure	noise
Health domains	other
Type of research	cohort study

Road traffic noise and all-cause mortality in the Netherlands

Background: Road traffic noise exposure could lead to hypertension. Hypertension is one of the most important risk factors for mortality. Aims: To assess the effect of road traffic noise on all-cause mortality in the Netherlands. Methods: We selected from all residents in the Netherlands a cohort of 20 years and older living for at least 5 years on the same address at January 1 2004 using the Dutch municipality administration made available by Statistics Netherlands. This population was followed up until 31 December 2010. Information was available on vital status, age, gender, marital status, country of origin and standardised household income. The annual average Lden (day-evening-night equivalent level) was calculated for all residential addresses in the Netherlands in 2004. Statistical analyses were carried out using a Cox proportional hazard model. Noise exposure was included as 5 dB categories (from <50 dB to ≥ 70 dB) as well as continuous exposure indicator. Results: Almost eight million inhabitants fulfilled the selection criteria. Linkage with the noise exposure was successful in about 98% resulting in 7,676,185 million subjects with complete data. In the 7 years follow up period there were 658,751 deaths. The estimates of the 5 dB categories rose monotonously from 50 dB (15% of the population); the hazard ratio (HR) for the highest exposure category (≥ 70 dB; 0.2% of the population) was 1.073 [95% CI 1.017-1.133]. The HR was 1.036 [95% CI 1.030-1.041] per 10 dB increase for the continuous exposure indicator with a threshold of 50 dB. Conclusion: The results suggest an association between noise exposure from road traffic at home and all-cause mortality going down to low exposure levels.

Abstract Number	**O-4-28-05**
Presenter	Carla M T Tiesler*, Matthias Birk, Elisabeth Thiering, Gabriele Kohlböck, Sibylle Koletzko, Carl-Peter Bauer, Dietrich Berdel, Andrea von Berg, Wolfgang Babisch, Joachim Heinrich
Exposure	noise
Health domains	mental health
Type of research	cohort study

Exposure to Road Traffic Noise and Children's Behavioural Problems and Sleep Disturbance: Results from the GINIplus and LISAplus Studies

Background: Exposure to transportation noise showed negative health effects in children and adults. Studies in children mainly focussed on aircraft noise at school. Aims: We aimed to investigate road traffic noise exposure at home and children's behavioural problems and sleeping problems. Methods: 872 10-year-old children from Munich from two German population-based, birth-cohort studies with data on modelled façade noise levels at home and behavioural problems were included. Noise was assessed by the day-evening-night noise indicator Lden and the night noise indicator Lnight. Behavioural problems were assessed by the Strengths and Difficulties Questionnaire (SDQ). A subgroup (N=287) had information on sleeping problems. Continuation ratio models (logistic regression models) adjusted for various covariates were applied to investigate the association between interquartile range increases in noise and SDQ scales (sleeping problems). Results: Noise measured by Lden at the most exposed façade of the building was related to more hyperactivity/inattention (continuation odds ratio (cOR)=1.28(95%-confidence interval(CI):1.03-1.58). Noise at the least exposed façade increased the relative odds for having borderline or abnormal values on the emotional symptoms scale, especially the relative odds to have abnormal values for a subject with at least borderline values (Lden:cOR=2.19(95%CI:1.32-3.64). Results for Lnight were similar. Nocturnal noise at the least exposed façade was associated with any sleeping problems (odds ratio (OR)=1.79(95%CI=1.10-2.92)). Conclusions: Road traffic noise exposure at home may be related to increased hyperactivity and more emotional symptoms in children. Future longitudinal studies are required to explore noise exposure and behavioural problems in more detail, especially the role of sleep disturbances.

Abstract Number	**O-4-28-06**
Presenter	Jorunn Evandt*, Bente Oftedal, Norun Hjertager Krog, Per E. Schwarze, Per Nafstad, Sidsel Graff-Iversen, Gunn Marit Aasvang
Exposure	noise
Health domains	cardiovascular disease
Type of research	cross-sectional study

Traffic noise, insomnia and risk factors for cardiovascular disease

Introduction: In Norway it is estimated that about 1.7 million people are exposed to traffic noise at levels exceeding recommended guideline values at their home. It is estimated that 5 % of the population experience sleep disturbances as a result of environmental noise. Exposure to traffic noise has also been associated with hypertension and cardiovascular disease (CVD). Furthermore, poor sleep has been associated with increased risk of type 2 diabetes and CVD. However, whether insomnia serves as an intermediate factor between exposure to night-time traffic noise and risk factors for CVD is still uncertain. Aims: The main aims of this project are to study the associations between 1) nocturnal traffic noise and sleep disturbances, 2) nocturnal traffic noise and sleep medication use, and 3) sleep disturbances induced by traffic noise and risk factors for CVD. Methods: Risk factors for CVD were measured in the Oslo Health Study (HUBRO) (2000-2001). A follow-up study of HUBRO, "Health and Environment in Oslo" (HELMILO) (2009-2010) (n = 13 019) added self-reported data on, among others, sleep problems. The noise levels outside each participant's dwelling were calculated using the Nordic Prediction Method for railway and road traffic noise in combination with a geographical information system. The noise data will be linked to individual use of sleep medication according to the Norwegian Prescription Database. Potential confounders will be included in the analyses. Results: Only preliminary results are available. Data from HELMILO showed that 19 % of the subjects reported various degrees of disturbance from road traffic noise at night-time. Among those who were disturbed 37 % reported to experience inadequate sleep three times or more per week compared with 16.4 % among those who were not disturbed. These data will be analyzed further related to noise exposure and presented at the conference.

Abstract Number	**P-1-01-01**
Presenter	Hao-Yu Lu*, Shih-Wei Tsai, Shih-An Tsai, Chien-Lin Huang, Shih-Chi Chu, Chia-Sheng Cheng, Tsung-Kuan A Chou, Li-Peng Wang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

A New Real-Time Technique for Complex-mixture of Volatile Organic Compounds Monitoring

Background In this study, a new miniaturized complex-mixture gas analysis device, TCT-MiTAP, which leverages advanced electronic technologies, nano-materials, and innovative sensing architecture, was validated for the measurements of mixed volatile organic compounds (VOCs). Aims Use a New Real-Time Technique to determine mixed VOCs in different settings. Method Eight different concentrations of the mixed VOCs around the permissible exposure limits (PELs) levels, which include 1,4-dioxane, tetrahydrofuran (THF), trichloroethylene(TCE) and tetrachloroethylene (TetraCE), were prepared by the standard gas generation system in the laboratory. The device then was calibrated based on NIST traceable standard gases. On-site air sampling tests were finally conducted by the device in four field environments. The test results were compared with those obtained by standard method - Taiwan Environmental Analysis Laboratory A715.14B. Results The results of laboratory tests showed that the four mixed VOCs can be detected simultaneously with method detection limits (MDLs) as low as 1.92ppb, 6.05ppb, 1.02ppb, and 0.28ppb, for 1,4-dioxane, THF, TCE and TetraCE, respectively. No statistical difference was found when sampling at different temperatures (25, 30, 35□C) and humidity (8, 40, 80%). For the various-concentrations tests, the results from all the mixed VOCs showed good linearity (R2>0.995) with coefficient of variations (CVs) all <10%. The field test results by the device were in close correlation with those by the A715.14B method. Conclusions The technique has combined merits of high sensitivity/specificity like GC/MS and portability like eNose, those are critical to meet rigorous requirements of on-site applications of occupational and environmental monitoring.

Abstract Number	**P-1-01-02**
Presenter	Marco Bedogni, Silvia Moroni, Bruno Villavecchia, Luca Percich, Ario Alberto Ruprecht*, Constantinos Sioutas
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Adopting Black Carbon/Elemental Carbon as a Tool in Mobility Planning: the General Urban Traffic Plan of the City of Milan, Italy

Background. As part of the Strategic Environmental Assessment (SEA) procedure of the General Urban Traffic Plan, the Municipality of Milan introduced Elemental Carbon - basing on the experience with the air quality measurement of Black Carbon within the city - among quantitative indicators. Aims. To obtain a particulate toxicity indicator, easy-to-use within the normal planning activities of a local Public Authority, estimating environmental and health potential effects of different policy scenarios. Methods. Being the carbonaceous nanoparticles such as Black Carbon (BC), a sensitive indicator of the spatial variation of road traffic emissions (‘traffic proximity’ indicator), the emissions of Elemental Carbon (EC), pollutant closely related to BC, have been adopted as tracers of the population exposure. According to the literature, a critical distance from the vehicular traffic source has been identified to which refer evaluations of some health effects that have 'sufficient evidence' (in. asthma). People living at a distance <75 m from major roads have an increased probability by about 30% of receiving a diagnosis of asthma and by about 40%-50% to be on medication for asthma or have had recent acute episodes in children (McConnell et al, 2006; Perez, 2012; Brugge et al, 2007). Thus an exposure indicator has been defined as the daily mean vehicular EC emissions released at a distance less than 75 meters from places of residence. This indicator has been estimated for several mobility planning scenarios. Results. This approach has proven to allow easy scenario comparison analysis. In the city of Milan, road pricing scenario at 2015 leads to an increase of total population exposed to lower emission levels (<10 grams/day) and to a decrease of total population exposed to highest emission levels (>50 grams/day). Conclusions. BC/EC, excellent tracer of 'traffic proximity‘ exposure, offers the possibility to verify the effectiveness of different policies in mobility planning.

Abstract Number	**P-1-01-03**
Presenter	Subhash Pawar*
Exposure	ambient air pollution
Health domains	allergies
Type of research	health impact assessment

Air ion variation during morning period (06:00-08:00 hours) at rural station Ramanandnagar (17° 4' N 74° 25' E) India

Air ion variation during morning period (06:00-08:00 hours) at rural station Ramanandnagar (17° 4' N 74° 25' E) India S.D. Pawar ABSTRACT The atmospheric-electric processes can be understood only if it is assumed that the atmosphere is electrically conducting. The presence of aerosol in the air was found to be very greatly affecting the conductivity. Since the aerosol particles are very large compared to the ions, an ion is more likely to strike against aerosol-particle, and give up its charge to it or to adhere to the surface, than to collide with an ion of opposite sign. In this way, the rate of loss of conductivity is rapid. To measure small currents (AD549JH) amplifier is used by converting it into a voltage, which is usually linearly related to the input current. In January average positive air ions were 9x102 ions per cm3, starts decreasing and reaches to minimum (1.2 x102 ions per cm3) in April. From May starts increasing and reaches to 9.1 x102 ions per cm3 in June. Average negative air ions were 6x102 ions per cm3 in January. In February average negative air ions were 5.85 x102 ions per cm3. From February starts decreasing and reaches minimum (1.2 x102 ions per cm3) in April. In June average negative air ions were 9.4 x102 ions per cm3. Average negative air ions were 3 x102 ions per cm3 in July. From July average negative air ions starts increasing and reaches maximum (8.2 x102 ions per cm3) in September. The air quality is depends on number of negative air ions present in the atmosphere. In January as compared negative air ions positive air ions were more in the atmosphere. Therefore atmosphere in January month is very harmful to human health during morning period. Keywords: Aerosol, Air Pollution, Cluster ion, Air quality.

Abstract Number	**P-1-01-04**
Presenter	Geun-Bae Kim*, Yong-Sung Cho, Tack-Shin Kang, Kyung Chul Yang, Hye Jeong Jo
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Air pollution and Biological exposure near Large Integrated Steelwork

Background: Integrated steelwork make steel products through the process such as iron making, steelmaking, casting from iron ore and coal. Coal is transformed into coke by destructive distillation before being used as fuel in the blast furnace and lots of byproduct for manufacturing organic chemicals is gained and emitted into atmosphere. Aims: The survey was done on atmospheric situation and human biological exposure by steelwork its production capacity of 15 million tons near coastal area in Korea. Methods: The areas influenced were evaluated through atmospheric modeling and the atmospheric concentration of 48 pollutants including polyaromatic hydrocarbon(PAHs) were monitored at 4 sites. Heavy metals and some metabolite of organic chemicals in urine of about 600 inhabitants were investigated to assess the influence of steelwork on their exposure and health. Results: Atmospheric concentrations of PM10, Cd, Hg(gaseous), Bezo(a)pyrene near the steelwork were 53~64㎍/㎥, 1.1~0.7, 5.4ng/㎥, 1.13~0.26ng/㎥ which were higher comparing to comparison region (37.1, 0.6, 3.5, 0.37). Cadmium and Mercury concentration of in urine of habitants near steelwork were 0.99, 0.69㎍/L which were lower than those of comparison group. But metabolites of PAHs(1-hyroxypyrene, 2-hydroxy fluorene, 1-hydroxyphenanthrene) near steelwork were higher. There were no difference in metabolite concentration of phthalate and VOCs between areas. Multi-regression analysis showed that age(R2 15.8, p-value <0.0001) and intake of seafood(2.71, 0.01) contributed to the concentration of heavy metal in urine and region(R2 3.31, p-value <0.01) did in 2-hydroxyfluorene. Incidence ratio of asthma and allergic eye disease in questionnaire were 8.4%, 29.3%, which were higher than those(4.4, 13.6) of comparing group. Mortaliy rates of total and lung cancer near the steelwork and whole city were also higher comparing to that of other city and whole country. Conclusions: It was estimated that the emission from steelwork can influence on atmospheric situation and the health of habitants.

Abstract Number	**P-1-01-05**
Presenter	Sabrina Rovelli, Andrea Cattaneo*, Camilla Paola Nuzzi, Andrea Spinazzè, Silvia Piazza, Anna Clara Fanetti, Paolo Carrer, Domenico Maria Cavallo
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Airborne particulate matter in school classrooms of Northern Italy

Abstract Background - Indoor air quality in schools is a significant concern because children spend at least 30% of their week-days inside school buildings, where air pollutants can achieve high concentrations, and they are much more vulnerable than adults to the effects of air pollution. Aims - The primary aim of this study was to investigate PM mass concentrations in classrooms, evaluating the impact of indoor activities, outdoor sources and air exchange rates on indoor PM levels. Methods - PM2,5 and PM10 measurements were carried out in 9 schools of Northern Italy. Sampling was done from Monday morning to Friday afternoon in three classrooms of each school and was repeated in winter 2011-12 and 2012-13. At the same time, PM2.5 samples were also collected outdoors. Two different photometers were used to collect PM2.5 and PM10 -continuous data, corrected a-posteriori using simultaneous gravimetric PM2.5 measurements. Results - Indoor PM2.5 levels appeared to be correlated with corresponding outdoor concentrations, with mean I/O PM2.5 ratios generally < 1. It was estimated that most of the PM2.5 in classrooms was originated from outdoor sources. Children's movement, clothing and crowding of classrooms led to the resuspension of coarse particles and greatly contributed to increase indoor PM10 levels. Indeed, a statistically significant difference for PM10 was found between periods of school occupation - when PM10 was mainly composed by coarse particles and reached very high levels - and when rooms were empty. Cleaning activities also affected PM mass concentrations, especially for particles > 10 µm. No significant correlation was found between PM mass concentrations and air change rates. Conclusions - This study found high indoor PM levels in school classrooms - especially for PM10 - and indoor average PM concentrations often exceeded the recommended guideline values. This study was carried out in the framework of the "Sinphonie" and "CCM-Indoor school" projects.

Abstract Number	**P-1-01-06**
Presenter	Michele Uemura, Alfésio Braga, Elizabete Costa, Lourdes Martins, Luiz Pereira*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

ANALYSIS OF HEALTH RISK OF EXPOSITION TO FOOD FIRING PROCESS POLLUTANTS

Background: There are few studies in professional kitchens addresing air pollution and its effects on workers' health. Aims: To evaluate the relationship between environmental exposure and risks to the respiratory health of workers in kitchens. Methods: We used the European Community Respiratory Health Survey (ECRHS), validated in Brazil, to investigate the prevalence of respiratory symptoms in one hundred employees, fifty working in the kitchen and fifty working in the salon. The pollutants measurements were carried in and out of ten Buffet type restaurant kitchens and salons for particulate matter (PM2.5) we used the Dust Trak™ equipment with an interval of ten days and in duplicate, and for nitrogen dioxide (NO2) passive samplers were placed in triplicate for thirteen days. We used Chi-square and Mann-Whitney tests to compare the concentrations and respiratory symptons inside and outside the kitchens. Results: The signs suggestive of asthma and nocturnal cough, dyspnea and wheezing, wheezing without colds, chest tightness and medication use were more prevalent in individuals working in the kitchen when compared to employees of the salon. In relation to PM2.5measurements, the kitchen workers are exposed to concentrations twice as higher than workers in the salon in all the restaurants evaluated, in average 104.85 µm/m3 versus 51.34 µm/m3 respectively, and statisticaly significant (p<.0.05). The NO2concentration was also higher and statistically significant in the kitchens (p<.0.05). Conclusions: We concluded that exposure to PM2.5 and NO2inside the kitchens can be associated with a higher prevalence of symptoms suggestive of asthma, causing damages to the respiratory function of workers in these places. Therefore we suggest that control measures are needed in commercial restaurants in order to minimize the risks to the health of these workers.

Abstract Number	**P-1-01-07**
Presenter	Pernilla Almerud*, Peter Molnar, Lars Barregård, Gerd Sallsten
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Annoyance due to wood smoke in communities where domestic wood burning is common

Background and aims: Biomass burning for domestic heating has increased in many countries with cold climates in recent years. Biomass burning emits a number of gaseous and particulate pollutants, which can affect both the owners of the appliance and their neighbours. Complaints regarding wood smoke to local authorities are common during wintertime in Sweden. The aims of the study were to investigate the frequency of annoyance due to wood smokeand the levels of air pollutions in two small Swedish communities. This abstract presents the annoyance due to wood smoke experienced among residents in two communities. Typical local contributions of PM2.5 from wood burning are one or a few µg/m3. Methods: Annoyance due to wood smoke was investigated during wintertime in two residential areas in Hagfors (one where wood burning (WB) was common and one equipped with district heating (DH)), and in another WB area in Tanumshede with a history of complaints regarding wood smoke. A questionnaire including three questions on annoyance to wood smoke was distributed to all residents (response rate 61-86%). Results:As expected, the fraction of persons annoyed or very annoyed due to smell of wood smoke in Hagfors was higher in the WB area (8%) compared to the DH area (2%). Difficulty in airing the home due to smell of wood smoke was common in the WB area, 4% answered that this occurred often and 20% sometimes. The fraction of persons that were often (once a week or more) annoyed due to wood smoke in or near their home in Tanumshede was 10%, compared to 2% in the general Swedish population. However, if one has a neighbour within 200 m who uses biomass for space heating, annoyance in the general population increased to about 4%. Conclusions: In spite of moderate PM contributions, self-reported annoyance due to wood smoke was more pronounced and common in residents in the two WB areas compared to the DH area and the general Swedish population.

Abstract Number	**P-1-01-08**
Presenter	Judah Shashank, Ilan Levy, Barak Fishbain, David M. Broday*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Application of distributed sensor networks for estimating exposures to air pollution in urban areas

Background: Urban air quality is a major concern given the health effects associated with traffic related air pollutants. To date, exposure estimates used in environmental epidemiology studies are unable to resolve the fine spatial structure of air pollution at urban areas, where emission sources and sinks are extremely variable both in space and in time and create microenvironments of great diversity. New technologies recently emerged based on mini sensors for air pollutants. Aims: Test the applicability of mini air pollution sensors for an urban environment as distributed sensors network (DSN). Methods: 1.Sensors for several pollutants (NO2, O3, CO) as well as temperature and relative humidity were compared to standard air quality monitors (AQM) at Haifa, Israel. 2. At an “across the street” experiment, sensors were placed on opposite sides of a busy road. 3. Sub-neighborhood scale variations were examined by mounting the sensors on private vehicles. Results: Sensors collocated at a roadside and an urban background AQM sites showed good agreement with standard measurements, though with significant bias during periods with high RH. Excellent correlations between traffic related primary pollutants were observed, which deteriorated as the distance to traffic increased. When placed across the street, higher NO2 and CO (5 ppb and 0.4 ppm, respectively) and lower O3 (13 ppb) concentrations were measured by the downwind vs. the upwind sensors. At the sub-neighborhood scale, the sensors were able to detect the fine spatial pollution structure near busy vs. quiet streets. A clear spatial negative correlation between NO2 and O3 concentrations was obtained. Conclusions: DSN have a potential to complement standard urban AQM networks, and may provide improved exposure estimates at the individual and the population level. Further research is needed for improving the current technology, analysis and interpretation of the measurements, and for accounting for the effect of ambient conditions as well as cross interference with other pollutants.

Abstract Number	**P-1-01-09**
Presenter	Thomas Bateson*, Leonid Kopylev
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

Aspects of exposure measurement error in epidemiologic cohort analyses using the Libby amphibole asbestos worker cohort. Influence of changes in exposure assess

Background: The extent of employees' work history covered by measured exposures has been shown, using meta-analysis, to be an important predictor of summary effect measures for lung cancer mortality risk associated with asbestos exposure. We studied lung cancers associated with exposures at the asbestos-contaminated vermiculite mine in Libby, Montana, a major supplier of vermiculite demand during the 20th century. The cohort of workers includes those hired after 1935 with mortality follow-up through 2006. The associated job exposure matrix is based on measured fiber exposures from 1968-1982. Prior to 1968, exposures were largely estimated based on extrapolation of job-specific exposures in the late 1960's backwards in time to 1935 with an expert consideration of changes in workplace processes over time. Aims: To evaluate the influence of exposure measurement error on lung cancer potency estimates. Methods: We estimated the effect of occupational exposures on lung cancer mortality using the time-varying Cox regression model for different cohorts depending on worker's dates of hire in order to gauge the impact of potential exposure measurement error over time. Supplemental analyses assessed the inclusion of the percentage of work-history covered by measured exposure as a time-varying covariate. Results: Compared to previous published analyses based on the cohort of workers hired after 1935, when exposures assignments from the job exposure matrix were based on measured exposures only 47% of the time, our analyses based on higher quality exposure data from workers hired after 1959, when occupational exposures were predominantly based on measured exposures (85%), yielded an effect size as much as 3.6 times higher. Conclusions: Future occupational cohort analyses should continue to refine retrospective exposure assessment methods and explore new methods to control for changes in the quality of exposure estimates over time. Disclaimer: This abstract does not necessarily reflect EPA policy.

Abstract Number	**P-1-01-10**
Presenter	Patrick Ryan*, Chris Wolfe, Grace LeMasters, James Lockey, Sang Young Son
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Assessing Personal Exposure to Ultrafine Particles: A Field Test with Asthmatic Children

Background: Epidemiologic studies of air pollution are often limited by surrogate, ambient, or modeled estimates of exposure. Personal monitoring is ideal, particularly for children who spend time in locations outside of their home including schools, playgrounds, and school buses. Aim: To conduct a field test of a novel personal sensor for measuring ultrafine particle (UFP) exposure on a panel of asthmatic children. Methods: A newly developed sensor capable of measuring exposure to UFP number concentration (p/cc) with high spatiotemporal resolution was worn by inner-city children with asthma. Personal sampling began prior to riding the school bus and continued approximately 4 hours. Real-time UFP concentration was determined for each participant's home, school, and transit microenvironment. Participants also provided feedback regarding their experience with the sensor. Results: Recruitment is ongoing and, to-date, 7 asthmatic children have completed the field test wearing the sensor for an average of 4.25 hours during two consecutive days. GPS coordinates obtained during sensor operation allowed for the visualization of spatiotemporal exposure. Overall, average personal exposure to UFP was 19,300 p/cc. Average exposures inside schools (8,500 p/cc) were significantly less than during transit (21,000 p/cc) and at home (19,800 p/cc). Parents and children reported that, overall, the personal sensor was easy to use, rating it an average a score of 4.2 and 4.3 out of 5, respectively. Conclusions: The personal sensor is capable of measuring continuous real-time exposure to UFP with high spatiotemporal resolution. High usability scores demonstrate that the sensor is able to be worn by vulnerable children. Personal exposure to UFP was highest during transit on diesel-powered school buses and at homes where cooking, tobacco use, and other sources may contribute to indoor particle exposure. Field testing will continue with measurements of respiratory health of participants.

Abstract Number	**P-1-01-11**
Presenter	Silvia Moroni, Ario Alberto Ruprecht*, Giuseppina Tosti, Bruno Villavecchia, Grisa Mocnik, Constantinos Sioutas, Dane Westerdahl
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Black Carbon as a new air quality and health indicator of traffic limitation interventions in Milan: the 'Area C' LEZ monitoring campaign

Background. In the framework of the implementation of a new Limited Traffic Zone (LTZ) scheme for the city center called 'Area C', the Milan Municipality has carried out an air quality monitoring project based on measurements of Black Carbon (BC), which is considered a valuable additional air quality metric to evaluate the health risks of primary combustion particles from traffic including organics (WHO, 2013). Aims. To assess the environmental and health potential effects of the 'Area C' LTZ by mean of an indicator of particulate toxicity. Methods. BC, PM10 and PM2.5 real-time measurements were performed contemporaneously in and outside LTZ, in different seasons for several weeks, both at residential and kerbside fixed sites. BC concentrations were measured with Aethalometers (Magee, USA) while PM with Aerocets (MetOne, USA). Results. At kerbside sites in summer, during working days with LTZ in force, in and outside Area C 24h mean (SD) BC concentrations were 2.5 (0.6) mg/m3 and 4.7 (2.1) mg/m3 respectively ($p<0.0001$), which represents an absolute difference of 2.2 (1.7) mg/m3 or -47% inside LTZ as compared to the outside area. BC/PM10 and BC/PM2.5 ratios were 55% and 64% lower inside LTZ. At third floor residential sites, in winter season, in and outside Area C 24h mean (SD) BC concentrations reached a value of 5.6 (1.9) mg/m3 and 7.8 (2.5) mg/m3 respectively ($p<0.0001$), with an absolute difference of 2.2 (1.3) mg/m3 or -28% in the LTZ. BC/PM10 and BC/PM2.5 ratios were 32% and 25% lower inside LTZ. No statistically significant changes were found in PM10 and PM2.5 concentrations. At residential sites, fall campaign showed an halving of BC percentage difference between in and outside the traffic restriction zone with heating plants switched-on (-12% vs -33%). Conclusions. A significant difference was found in BC concentrations inside 'Area C' LTZ, with an improvement of one to two BC epidemiological 'change units', a remarkable reduction in particulate toxicity and related expected mortality and morbidity (Janssen et al., 2011).

Abstract Number	**P-1-01-12**
Presenter	Michael J. Gatari Gichuru*, Vincent Kivaya, Johan Boman, David M. Maina, Annemarie Wagner
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Black Carbon, Trace Elements and Particulate Matter levels in the ambient air of the Jomo Kenyatta International Airport-Nairobi

There have not been any air pollution studies at airports in Africa and indeed at the Jomo Kenyatta International Airport (JKIA), Nairobi, despite a growing global concern on the effect of airports on air pollution. Airport related emission sources pose a direct threat to the health of airport workers, users and surrounding communities. The study was carried out at JKIA between May 6th 2011 and May 17th 2011 with the aim of assessing particulate air pollution at the airport and its implications on human health. Sampling for outdoor and indoor air pollutants was done using an Andersen TM dichotomous impactor and cyclonic personal samplers. These air samplers collect particulate matter (PM) of size PM10 and PM2.5 (Particles with aerodynamic diameters less than 10 µm and 2.5 µm respectively) on Teflon™ filters. Outdoor air sampling was carried out for 12 hours and for eight hours indoors. In both cases, sampling was done twice a day i.e. day time and night time. The shorter indoor period was chosen to mimic the normal working hours of staff at the airport. Atmospheric mass concentration levels of PM (PM10 and PM2.5) were determined gravimetrically, black carbon (BC) by use of a reflectometer while trace elements were determined using Energy Dispersive X-Ray Fluorescence (EDXRF) spectroscopy. Median day time outdoor PM10 and PM2.5 atmospheric mass concentrations (41 µg m-3 and 9 respectively) at JKIA were found to be lower than the Kenyan draft limits (50 µg m-3 and 35 respectively). Median day time outdoor BC concentrations in the PM10 and PM2.5 size fractions were 4.0 µg m-3 and 3.3 respectively. The maximum night time outdoor elemental concentrations for zinc (Zn) and lead (Pb) were 1000 ng m-3 and 51 respectively in the PM2.5 size fraction particles. The concentrations of PM and detected elements indicate that the air at JKIA is not more polluted than at other public places in Nairobi and Africa.

Abstract Number	**P-1-01-14**
Presenter	Brett Tunno*, Leah Cambal, Courtney Roper, Sheila Tripathy, Drew Michanowicz, Jessie Carr, Jeffrey Howell, Sara Gillooly, John Gorczynski, Holger Eisl, Jane Clougherty
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Comparison of 24-hour vs. Inversion-Period Integrated Samples of PM2.5 and Elemental Carbon in Pittsburgh, PA, USA

Background: Pittsburgh, Pennsylvania is home to local industrial sources of air pollution, periods of heavy traffic congestion, a complex terrain of river valleys and hills, and frequent atmospheric subsidence inversions. A two-year monitoring campaign was designed to capture intra-urban seasonal variability in fine particulate matter (PM2.5) and elemental carbon (EC) concentrations. Inversion-focused integrated monitoring was performed during year one (2011-2012), vs. 24-hour integrated sampling during year two (2012-2013). Methods: Spatial distributions of local pollution sources (i.e., traffic, industry) and potential modifiers (i.e., elevation) were explored via geographic information systems (GIS). Sampling locations (n=38) were allocated to capture spatial and source variability across a metropolitan domain (~150 sq. miles). Results: In year one, we found temporally-adjusted mean PM2.5 concentrations of 14.1 ± 3.6 µg/m3 for summer and 12.5 ± 2.4 µg/m3 for winter. In year two, we found slightly lower mean PM2.5 concentrations of 13.8 ± 2.8 µg/m3 for summer and 11.5 ± 3.7 µg/m3 for winter. Mean seasonal EC ranged from 1.3 ± 0.51 abs during winter to 1.80 ± 0.46 abs during summer for year one. Temporal variability, industrial land use, and elevation were significant predictors in land use regression (LUR) modeling, resulting in final pollutant-specific seasonal R2 from 0.58 for PM2.5 to 0.76 for EC during year one, and 0.71 for EC to 0.86 for PM2.5 during year two. Seasonal-specific factor analysis for trace metals will be performed for the four seasons, for source apportionment analyses. Conclusions: The paired 24-hour and inversion-focused stationary monitoring campaigns were used to explore spatial variability and seasonal contrasts in PM2.5 and EC concentrations under inversion conditions, improving source apportionment analyses. Industry and elevation were the stronger identified predictors of spatial variability for both PM2.5 and EC.

Abstract Number	**P-1-01-15**
Presenter	Chia-Pin Chio*, Chang-Fu Wu, Chang-Chung Chan
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Comparisons of air pollution levels measured on streets and fixed-site air monitoring stations

BackgroundStudies of air pollution levels on streets away from major roads, which are important exposure microenvrionments in large cities, are limited. AimsThis study tries to investigate whether fixed-site air monitoring data can predict air pollution levels on streets in Taipei, Taiwan. MethodsHourly PM10, PM2.5, SO2, NO2, CO, and O3 concentrations were measured at ten selected streets away from major roads for 5–10 days by a mobile air monitoring station in Taipei. Fixed-site air monitoring data near each of them were used for comparing air pollution levels at 24-hour averages, 8-hour averages, and three rush hours (9am, 7pm and 10pm) by linear regression analyses. Results 24-hour averaged levels of PM10, PM2.5 and NO2 on streets showed good correlation (r2=0.81–0.84) with fixed-site monitoring data but were about 28%, 30%, and 8% lower than the fixed-site data. 8-hour averaged levels of CO and O3 on streets showed moderate correlation (r2=0.70–0.71) with fixed-site monitoring data. CO concentrations on streets were about 9% higher than fixed-site monitoring data, while O3 concentration on streets were 23% lower than the fixed-site data. The correlation between mobile and fixed sites was the lowest for SO2 (r2=0.46) among all pollutants, and the SO2 levels on streets were about 55% of the concentrations measured at fixed-site stations. The correlation remained unchanged for the comparisons during rush hours except for CO. The regression slope for CO changed from 1.09 of 8-hour averages to 0.97 of rush hours. Conclusions We concluded that air pollution exposure for residents living on the streets away from major roads was lower than the measurements at the fixed-site monitoring stations. Limited accessibility of diesel vehicles on the streets explained why SO2 had the lowest slope and correlation among all air pollutants.

Abstract Number	**P-1-01-16**
Presenter	Jane Heyworth*, Anna-Lena Arnold, Andrea Hinwood
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Concentrations of NO2 and NOX across the Perth metropolitan area, Western Australia

Background Numerous studies have shown that high levels of air pollution are associated with adverse health effects, particularly in the elderly. The Health in Men Air Quality Study is investigating the health effects of long term exposure to air pollution in a cohort of 12,000 older men residing in Perth, Western Australia. This study is being undertaken in affiliation with the The European Study of Cohorts for Air Pollution program. Aims To describe NO2 and NOx concentrations from 43 sites across Perth by season and site type. Methods Ogawa passive diffusion badges were used to collect nitrogen oxide samples. Sites were selected to represent spatial variation of air pollution at the cohort home addresses across 3 categories: regional (n=2) and urban background (n=19) and street sites (n=22). Fourteen day samples were taken during 3 seasons in 2012.The annual average, median and range were determined, stratified by site type. Data were transformed using the square root and ANOVA was used to test for significant differences in means between site types. Results The median concentrations for NO2 and NOx for all sites and seasons were: 12.58µg/m3 (range 2.27–24.87, SD 5.69) and 21.31µg/m3 (range 3.59–59.76, SD 12.43). The highest NO2 and NOx median concentrations were found at street locations: 14.62 µg/m3 (range 5.90–24.87, SD 5.40) and 31.13µg/m3 (range 11.95–59.76, SD 11.74), followed by urban sites: 11.13µg/m3 (range 3.17–19.83, SD 4.32) and 17.64µg/m3 (range 4.79-36.36, SD 7.33) with the lowest concentrations found at regional sites: 2.98µg/m3 (range 2.27-3.70, SD 1.01) and 4.45µg/m3 (range 3.59-5.32, SD 1.22). Mean concentrations for NO2 and NOx were significantly different between each of the site types. Conclusions The NO2 and NOx median concentrations were low and below the Australian National Environmental Protection Measure standard for NO2. Concentrations were consistent with the lower concentrations reported by ESCAPE and showed similar trends by site type.

Abstract Number	**P-1-01-17**
Presenter	Shih-Chun Candice Lung*, Pao-Kuei Hsiao, Chun-Hu Liu, Chi Betsy Fu, Tzu-Yao Wen, Yu-Ting Cheng
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Contribution of different sources to community pollution levels in Taiwan

Background: Characterization of spatial variability of pollutant levels is important to actually assess the residents' exposure in their communities. Especially in Asian countries, mixed commercial and industrial activities, such as restaurants, temples, and home factories, exist within residential communities. Moreover, Asian residential housings are built along the roadways with heavy traffic in front of them. This phenomenon results in higher intra-community pollution variability than those in the western countries. Aim: The objective of this study is to assess the contribution of various neighborhood air pollution sources to ambient pollution levels in twelve communities in Taiwan. Methods: Monitoring was conducted in twelve communities in June-August 2010 in Taipei metropolitan, Taiwan. Real-time monitoring was conducted with instruments for PM2.5, PM10, and CO. Ten locations within each communities were selected due to their different characteristics; one location is selected as background (without any obvious sources in the surrounding), and the others are with different air pollution sources such as traffic emission, restaurant, temple, or home factory. Monitoring was conducted for 10 minutes at each location. Generalized estimating equation (GEE) regression was applied to assess the contribution of various air pollution sources to community air quality. Results: The average concentrations for PM2.5, PM10, and CO are 36.0µg/m3, 61.9µg/m3, and 4.0ppm, respectively. The results also showed significant pollution variations within one community. Based on the GEE results, each restaurant or temple contributed to 14.9 or 17.9µg/m3 of PM10, respectively, to the community air pollution levels. The contributions of different sources to community PM2.5 and CO levels will be assessed further. Conclusions: These results demonstrated the importance of assessing intra-community pollutant variability in Asian cities for air pollution and health effect studies. Keywords: community air pollution, mobile monitoring, traffic, cooking, religion emission

Abstract Number	**P-1-01-18**
Presenter	Gerd Sallsten*, Peter Molnar
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Contribution to PM2.5 from domestic wood burning in a small community in Sweden

Background The use of wood stoves and fireplaces for heating is quite common in homes in many countries with cold climates. The rising importance of biomass emissions in ambient air increases the demand to quantify the contribution in local settings. Aim The aim was to investigate and quantify the contribution to ambient air from domestic biomass burning for space heating in a residential area with two different methods. Methods Daily 24 hours PM2.5 samples during 151 days in the winter season 2007-08 were collected using a weekly PM2.5 sampler at two sampling places, one in a wood burning area and the other at a reference station without any houses with domestic wood burning nearby. After determination of mass concentration, a subset of the filters (paired from 28 days) was selected for chemical analysis. Black carbon, BC, and elemental concentrations were determined using EDXRF. The 28 days were chosen based on trajectory analysis to be days with low long range contribution. Source apportionment analysis was carried out by Positive Matrix Factorisation (PMF) technique using the US EPA-PMF 3.0. Results The mean extra local contribution from domestic wood burning in the wood burning area on days (n=57) with Marine or Nordic air masses was estimated to about 0.7-1.1 µg m-3.For the PMF analysis a five factor model was used and the following sources were identified; Long range transported (LRT), Biomass, Sea salt, Soil, and Traffic. All factors, besides the Biomass burning, were very similar in source strength at both places, indicating that the only real difference between the two areas was the presence of biomass burning. The PMF analysis resulted in a mean of 0.6 µg m-3 addition relative to the reference location. Conclusion The simpler method (using mass concentration/air masses) estimated the mass contribution as well as PMF modelling and can therefore be a time- and cost-effective first step.

Abstract Number	**P-1-01-19**
Presenter	Héctor Saúl López Campos*, Leticia Hernandez Cadena, Betzabet Quintanilla Vega, Isabel Alvarado Cruz, Marco Antonio Sanchez Guerra, José Luis Texcalac Sangrador, Alan Castillo Ferraez, Andrea De Vizcaya Ruíz
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Description of Industries sources to enviromental exposure to benceno in chidren from Ecatepec, county in Mexico

Background Ecatepec County in Mexico City Metropolitan Area is highly industrialized and considered as one of the most polluted area; however there are no reports about other air pollutants. Objects To describe the sources of environmental exposure to benzene by industrial emissions for children 7-10 years of age from three primary schools from Ecatepec County. Methods: A cross-sectional study was conducted in 170 school children (7-10 years old) enrolled at three different schools from Ecatepec County; urinary concentrations t,t-muconic acid (t,t-MA) as indicators of benzene exposure was determined by HPLC. We take data of inventory of industries from local government were characterized potential point sources for benzene in Ecatepec. Themselves, the homes children´s and industries were located as through a Geographic Information System (GIS). For each child, we calculated the number of industries and distance to nearest industry and assessed the relationship between estimated emissions of VOCs with the metabolite levels. Results: The average of AM levels was 233.3 mg / g creatinine (SD = 245.13), being higher in the students of the school in San Cristobal (Mean = 318.89, SD = 257.5). At a distance of 500 meters, each school had an average 65 industries with 36.78 tons of VOCs (SD = 204.14) by year in average. Each industry was assigned to 13 children on average (SD = 7.9). The predominant industry in the area was the metal followed by chemistry and food, but the industry emitting more VOCs was for cement for construction followed by chemical and fertilizer. A nonlinear relationship was observed between total VOCs emissions and AM levels in children especially in children whose industries were less than 500 meters. Conclusion: Exposure to benzene in these children can be broad impact in terms of health; exposure characterization in this area shows a population at risk that could be exceeding the permissible limits. It is important to consider strategies to mitigate the damage.

Abstract Number	**P-1-01-20**
Presenter	Gillooly Sara*, Leah Cambal, Joshua Feinberg, Mike Jackson, Jessie Carr, Drew Michanowicz, Brett Tunno, Jane Clougherty, Kyra Shields
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Development and Validation of a Magnetic Method Using Deciduous Tree Leaves to Obtain Spatially-Resolved Air Pollution Measurements in Pittsburgh, PA, USA

Background: Many epidemiological studies rely on sparsely-allocated US EPA monitoring networks, because spatially-resolved information on ground-level air pollution variation is often lacking. As a result, there is growing need for cost-effective methods to capture intra-urban variability in pollution exposure, and to identify key sources. Aims: Using Norway maple leaves as biomonitors, we aim to develop and validate a cost-effective method of obtaining spatially-resolved outdoor air pollution measurements via magnetic techniques. Methods: Using geographic information systems (GIS)-based data, we characterized citywide Norway maple trees against local air pollution sources and modifiers (i.e., traffic density, proximity to industry, elevation). We sampled leaves from systematically selected locations, and examined magnetic properties of particles on leaf surfaces via magnetic remanence and susceptibility techniques. Magnetic data from leaf surfaces will be compared against: a) co-located leaf and filter magnetic measurements, b) elemental concentrations of co-located leaf and filter samples analyzed via inductively-coupled plasma mass spectrometry (ICP-MS), and c) local air pollution source indicators, for spatial source apportionment. Results: Magnetic data, including coercivity, remanence, and median destructive field values, indicate predominantly magnetically soft, magnetite-like materials in varying concentrations across Pittsburgh. Preliminary analysis signifies particles in the single domain to pseudo-single domain range (diameter 1-20µm). ICP-MS analysis of co-located leaf and filter samples is ongoing. Conclusions: Preliminary analyses suggest that deciduous leaves may be useful biomonitors for magnetic loadings of particulate air pollution, offering a cost-effective method for obtaining spatially-resolved air quality information. Correlations between magnetic data and elemental concentrations will be explored. Ongoing analyses seek to determine whether magnetic data is amenable to spatial source apportionment.

Abstract Number	**P-1-01-21**
Presenter	Duck Shin Park*, Hee Man Kim, Gwangjae Lee, Mona Loraine Barabad, Youngmin Cho, Sangwon Ko, Kiyoung Lee
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Emission Characteristics of Particulate Matters and VOCs in Cow Dung Combustion

Emission Characteristics of Particulate Matters and VOCs in Cow Dung Combustion Biomass fuel has been greatly used for cooking especially in developing countries and several studies have concentrated on the toxicity level of the combustion emissions. This study focused on the characteristics of particulate matter(PM) and VOCs from cow dung combustion. Data collection and results from the combustion were taken from the usage of a dual cone calorimeter, in which it showed that the heatflux, 50kW/m2 has the highest CO2 yield having 1,407.7138.2 mg/kg. When the temperature is high, the combustion will also increase. The concentrations of PM and VOCs were determined using a dust spectrometer and gas chromatography/mass spectrometry, respectively. The outcome of the tests presented that PM10 concentration were highest at 15kW/m2 with a total of 1,660.0709.5 g/m3. On the other hand, VOCs like benzene and toluene were detected during lower combustion temperature. Higher heat rate may cause an ample amount of CO2 concentration release, however, it also causes some VOCs and ultrafine dusts undetected. The generation of ultrafine dusts and VOCs was particularly high when the combustion temperature was low.
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Abstract Number	**P-1-01-22**
Presenter	Brett Tunno*, Leah Cambal, Jessie Carr, Courtney Roper, Sheila Tripathy, Lauren Chubb, Drew Michanowicz, Jeffrey Howell, Sara Gillooly, John Gorczynski, Jane Clougherty
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Exposure Assessment and Spatial Variation of PM2.5 and Elemental Carbon in Downtown Pittsburgh, PA, USA

Background: The city of Pittsburgh, Pennsylvania is historically associated with high levels of air pollution, and has been designated a federal PM2.5 non-attainment area. Though most industrial sites, including steel mills and coke plants, have been eliminated, periods of heavy traffic congestion are still present, especially in the downtown area. A saturation monitoring campaign was designed to capture spatial variability in fine particulate matter (PM2.5) and elemental carbon (EC) within the downtown core, with an emphasis on diesel-related sources. Methods: Geographic information systems (GIS) was used toexplore spatial distributions of local pollution sources, such as traffic. Sampling locations (n=40) were allocated to capture spatial and source variability across a small domain of 1.75 square miles. Sites were classified based on total traffic density, truck traffic density, and bus route density. Results: Preliminary data from our on-going winter 2013 sampling indicates temporally-adjusted mean PM2.5 concentrations of 12.8 ± 1.4 µg/m3, and mean EC concentrations of 2.7 ± 1.4 absorbance units. These concentrations are higher,on average, than those observed across 36 citywide sites (mean PM2.5 = 11.5 ± 3.7 µg/m3, and mean EC = 1.9 ± 1.1 abs). We will compare concentrations across site classifications, and by gasoline and diesel-specific indicators, for land-use regression (LUR) modeling and source apportionment. Conclusions: This stationary monitoring campaign explored spatial variability in PM2.5 and EC measures throughout downtown Pittsburgh during winter 2013. A repeat study during summer 2013 will provide for seasonal comparisons and further exploration of diesel-related indicators.

Abstract Number	**P-1-01-23**
Presenter	Claudia Limón*, Arturo Curiel Ballesteros
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Exposure to Manganese in Children: A Pilot Study in a City of Western Mexico.

BACKGROUND: Particulate matter in air readings in Guadalajara's Metropolitan Area, close to high-traffic roadways, detected the presence of manganese (Mn) (Curiel, 2011) (Saldarriaga, et al. 2011). Manganese is a pollutant that is of particular interest, as exposure to manganese affects child development. (Freeman, et al. 2001) (Wong, et al. 2004). Evidence of the neurotoxic effects of manganese on children is associated to hyperactive and disrupted behaviors (Chung, et. al. 2011) (Bouchard, 2007) (Ericsson, et. al. 2007). AIMS: To contribute to studies on chronic exposure to manganese among children during early periods of development. METHODS: The scoping study included 19 children ranging from 6 to12 years of age (median: 9 years) who had been diagnosed with hyperactive behavior, by means of an impulsiveness scale, by pediatricians and psychologists of the Comprehensive Family Development System's Behavior Clinic (Clínica de Conducta, Sistema de Desarrollo Integral de la Familia - DIF) of the Jalisco State government. To assess exposure to Mn, its concentration in 19 donated dental samples was determined, with prior informed consent. Teeth were cleaned in a sonicater and rinsed in distilled, deionized water; they were then treated with strong acid and analyzed by atomic absorption spectroscopy. A calibration curve was plotted and the equipment was programmed to analyze each sample under three repetitions. RESULTS: The presence of Mn was detected in all dental samples in a range of 0.3882-13.7134 ppm. The highest concentrations—above 8 ppm—were found at distances under 635 m and the lowest concentrations—below 4ppm—at distances over 1000 m. On average, the concentration for people residing at distances less than 635 m from high-traffic roadways was 6.44 ppm and for those residing at distances more than 1000 meters away, the average concentration was 4.73 ppm. CONCLUSIONS: The results of this study support further research on the risk of exposure to Mn among children.

Abstract Number	**P-1-01-24**
Presenter	Byeong-Kyu Lee*, Lee Byeong-Kyu
Exposure	ambient air pollution
Health domains	other
Type of research	case-control study

Indoor air germicide feasibility of silver doped TiO2/glass fiber photocatalyst under visible irradiation

This study investigated indoor air germicide feasibility of photocatalyst Ag-TiO2 supported on glass fiber prepared by a sol-gel method. A experimental model was designed to investigate bacterial disinfection efficiency of Staphylococcus, the most popular bacteria in hospital in Korea, by Ag doped TiO2/glassfiber photocatalyst. The silver content in Ag/TiO2 was altered from 1 to 10% to investigate the optimal ratio of Ag doped on TiO2/glass fiber for photocatalytic disinfection of Staphylococcus. This study confirmed that Ag in Ag doped TiO2/glass fiber can work as an electron sink or donor to increase photocatalytic activity and can also promote the charge separation of electron-hole pairs generated from TiO2 after photon absorption. Also, Ag acts as an intermediate agent for the transfer of photo-generated electrons from valance band of TiO2 to an acceptor (O2 gas) to promote for photo-oxidation process. The photocatalytic disinfection activity of Ag doped TiO2/glass fiber under visible light increased with the increase in silver content up to 7.5% and then slightly decreased with further increasing silver content. The highest disinfection efficiency and disinfection capacity of Staphylococcus using 7.5%Ag-TiO2/glass fiber were 75.23% and 20 CFU/s.cm2, respectively. The medium level of humidity of 60±5% showed better photocatalytic disinfection than the lower (40±5%) or higher (80±5%) levels.

Abstract Number	**P-1-01-25**
Presenter	Lihui Huang*, Zhihua (Tina) Fan, Chang Ho Yu, Linda Bonanno, Jin Young Shin
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

Measurement of soluble and insoluble hexavalent chromium in ambient particulate matter

Background: Hexavalent chromium (Cr(VI)), a pulmonary carcinogen, can present as both soluble and insoluble forms in environment, which may have different toxicities. It is thus important to separately quantify ambient Cr(VI) in both soluble and insoluble forms. Aims: To determine soluble and insoluble Cr(VI) in NIST 1648a (a reference urban particulate matter (PM)), ambient PM10 collected from 3 urban areas in NJ, i.e. Meadowlands, NJ Turnpike Exit 13 in Elizabeth and Rahway, and ambient PM10 collected from the suburban area in NJ, i.e. Piscataway. Methods: We developed a method to measure total Cr(VI) in ambient PM, which comprised collection of PM usinga Teflon filter, microwave extraction with 3% Na2CO3-2% NaOH, and detection with IC-UV (1,5-diphenylcarbazide colorimetry at 540 nm). The method detection limit was 0.33 ng/m3. Soluble Cr(VI) in ambient PM was measured by previously established method in our lab. Insoluble Cr(VI) was determined to be the difference between total Cr(VI) and soluble Cr(VI). Results: The soluble and total Cr(VI) in NIST 1648a were 1.75±0.24 mg/kg (N = 6, %CV = 14%) and 26.0±3.1 mg/kg (N = 4, %CV = 11.9%). The concentrations (mean±SD) of ambient soluble Cr(VI) in Meadowlands, Elizabeth, Rahway and Piscataway were 0.30±0.16, 0.21±0.13, 0.33±0.36 and 0.20±0.18 ng/m3 in the summer sampling period, and 0.11±0.04, 0.19±0.09, 0.14±0.07 and 0.03±0.01 ng/m3 in the winter sampling period. The concentrations of ambient total Cr(VI) in Meadowlands, Elizabeth, Rahway and Piscataway were 1.25±0.58, 1.56±0.48, 0.99±0.76 and 0.86±0.50 ng/m3 in the summer sampling period and 1.32±0.56, 1.41±0.56, 1.05±0.36 and 0.94±0.49 ng/m3 in the winter sampling period. Conclusions: Soluble and insoluble Cr(VI) co-existed in both NIST 1648a and collected ambient PM10. The soluble Cr(VI) in ambient PM10 accounted for 14.3 - 42.7% of total Cr(VI) in the summer, greater than 4.2 – 14.4% in the winter.

Abstract Number	**P-1-01-26**
Presenter	Allison P Patton*, Luz T Padró-Martínez, Jessica Perkins, Alex Bob, Wig Zamore, Doug Brugge, John L Durant
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Mobile monitoring of traffic-related ultrafine particles in near-highway neighborhoods in Boston, Massachusetts (USA)

Background: Intensive mobile monitoring data are needed for development of models for exposure assessment of ultrafine particles (UFP) and other traffic-related air pollutants in near-highway urban neighborhoods. Aims: The aims of this work were (1) to collect a data set that captured spatial-temporal variation of UFP in several neighborhoods near Interstate 93 (I-93; ~150,000 vehicles per day) and (2) to use this data to understand effects of differential urbanization on UFP. Methods: As part of the Community Assessment of Freeway Exposure and Health (CAFEH) study, we monitored for one year in each of three Boston-area neighborhoods near I-93 (a city center neighborhood with tall buildings and street canyons and two mixed residential/commercial neighborhoods), each paired with a residential neighborhood >1 km from I-93. Data was collected using a mobile platform equipped with rapid-response instruments on >30 days (2-6 hours day-1) in each neighborhood and included morning and afternoon sessions on weekdays and weekends in all four seasons to capture a wide range of traffic and meteorological conditions. Measurements were made of particle number concentration (PNC; 4-3,000 nm, a proxy for UFP) and other pollutants. Results: The neighborhoods had similar PNC levels <100 m from I-93; however, the degree of PNC attenuation varied inversely with urbanization. PNC 200-400 m from I-93 was lower than PNC <200 m from the highway by 5% in residential neighborhoods and 2% in the city center. Smaller decreases in PNC in the city center were likely due to street canyons and heavy local traffic. There was also less temporal variation in neighborhoods that were dominated by major roads. Within each neighborhood, temporal and spatial variation were approximately equal in magnitude. Conclusions: Mobile monitoring measures spatial variation and provides improved understanding of how city infrastructure affects PNC levels to inform the development of UFP models for exposure assessment.

Abstract Number	**P-1-01-27**
Presenter	Allison P Patton*, John L Durant, Elena N Naumova
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Monte-Carlo Analysis to Select Appropriate Mobile Monitoring Strategies for Characterizing Near-Highway Air Pollution in Urban Neighborhoods

Background: Due to the high costs of dense networks of stationary air pollution monitors to characterize traffic-related air pollution (TRAP) near busy roads, mobile monitoring is increasingly being used as an alternative. While studies illustrate the advantages of mobile monitoring for capturing fine-scale spatial differences, few studies describe the temporal resolution of mobile data needed to characterize the major temporal variations in TRAP. Aims: Our objectives were to use Monte-Carlo simulation of particle number concentration (PNC) to (1) assess the most likely time periods for highest and lowest PNC values, (2) understand the relationship between sample size (number of hours of monitoring) and error in estimates from a PNC regression model, and (3) make recommendations to optimize mobile monitoring. Methods: Mobile monitoring of PNC was conducted on 55 days over the course of one year in a 1 km2 densely populated area in Somerville (MA, USA) for the Community Assessment of Freeway Exposure and Health (CAFEH) study. An hourly regression model of PNC as a function of meteorology, traffic, and location was developed and used along with probability distributions to generate Monte-Carlo simulations of hourly ambient PNC. Results: On average, high PNC occurred on winter mornings and low PNC occurred on summer afternoons, constituting worst-case and best-case scenarios, respectively. We found that randomly selecting at least 100 hours throughout a year (i.e., on different days of the week and hours of the day) maximized the probability of capturing data that yielded accurate regression model predictions of PNC. Data collected only when extreme values were expected produced regression models with larger error than other strategies, including random sampling and always monitoring at the same time of day. Conclusions: Mobile monitoring on >100 randomly selected hours throughout the year in an urban residential area minimized error in PNC regression models.

Abstract Number	**P-1-01-28**
Presenter	Elisaveta Petkova*, Darby Jack, Nicole Volavka-Close, Patrick Kinney
Exposure	ambient air pollution
Health domains	other
Type of research	review

Particulate Matter Monitoring in Urban Africa: A review

Background Urbanization, coupled with increased industrialization, growing ownership of motor vehicles and continued use of biomass as domestic energy source, may lead to an increased burden of particulate matter (PM) pollution across the African continent. Despite the health risks this situation presents, air monitoring remains limited across the continent and many countries lack air quality standards. Aims We provide an overview of published PM monitoring studies in Africa, outline major themes, point out data gaps and discuss strategies for addressing particulate air pollution in rapidly growing African cities. Literature Review Methods PubMed, Medline-OVID, SciVerse Scopus and ISI Web of Knowledge searches were conducted in English to retrieve peer reviewed primary articles, as well as secondary or review articles that present or refer to identifiable PM monitoring data. Results Although few studies have reported annual mean levels of coarse and fine particles, collective evidence from short- and long-term air monitoring studies across urban Africa demonstrates that pollution levels often exceed international guidelines. Furthermore, pollution levels may be rising as a result of increased motor vehicle traffic building on already high background concentrations of PM in many locations due to climatic and geographic conditions. Conclusions Our review highlights a need for further attention to assessing PM pollution on the African continent, especially given the increasing motor vehicle traffic in recent years. A more systematic PM data collection would enable air pollution related health impact assessments, the development of strategies to reduce the air pollution health burden, and facilitate urban planning and transportation policy as it relates to air quality and health. Finally, building an air quality information system for publishing and sharing of monitoring data across academic, governmental and other institutions would greatly facilitate the characterization of PM pollution, as well as the planning and implementation of future studies.

Abstract Number	**P-1-01-29**
Presenter	Susanne Steinle*, Stefan Reis, Clive Sabel
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Personal exposure to particulate matter in different microenvironments – results from a pilot study

Background Individual behavioural and time-activity patterns lead to substantial variations of human exposure to ambient air pollutant concentrations. As a consequence static data from observation networks developed for regulatory compliance monitoring are of limited use to quantify personal exposure. Aims We aim to develop a method for measuring the pollution concentration while tracking a person's activities and location without interfering with every-day behaviour. Certain microenvironments (MEs) are commonly visited during a day and we investigate how the relative exposure difference between MEs affects personal exposure patterns between individuals. Methods We apply a budget portable device for particulate matter originally designed to monitor indoor air quality to assess ambient concentrations of PM2.5 in outdoor as well as in indoor environments. A GPS receiver, time-activity diaries and questionnaires, as well as follow-up meetings, were used to record data about peoples' activities and location. Results/ Conclusions Results from between Oct 2012 and Jan 2013 are presented. Based on the data collected, six microenvironments (MEs) have been defined. Time-activity data has been matched with particle concentration data to analyse ambient concentrations of PM2.5 in the identified MEs in space and time. We will present our analyses of differences between the respective MEs depending on activities, e.g. assessing how different MEs at certain times of day might show differences in exposure. The hardware is feasible for personal exposure measurements, but we have identified room for improvement regarding packaging and the integration of devices. Regarding the analysis process the matching of concentrations, timestamps and geographic coordinates with time-activity information is labour-intensive and error-prone. Detailed time-activity information and the follow-up meetings are crucial for the quality of the analysis.

Abstract Number	**P-1-01-30**
Presenter	Klara Slezakova*, Marta Oliveira, Cristina Delerue-Matos, Maria do Carmo Pereira, Simone Morais
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Pre-school children exposure to particulate-bound polycyclic aromatic hydrocarbons: levels and health risks

Background: Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental pollutants. PAHs exposure occurs mostly via ambient air. The EU settled a protective target of 1 ng/m3, expressed as annual mean of benzo[a]pyrene (B[a]P) in PM10 (Directive 2004/107/EC). Recently WHO also listed PAHs, particularly naphthalene and particulate matter (PM), as relevant indoor air pollutants. Nevertheless, various studies have shown that PAHs are predominantly associated with fine particles (PM2.5 and PM1) underlining the urgency for the respective regulations. Aims: The objective of this work was to assess the exposure and health risks of pre-school children to particulate-bound PAHs (16 US EPA priority compounds, benzo[j]fluoranthene recommended by the EU Directive, and dibenzo[a,l]pyrene due to its high carcinogenic potency) in school air. Methods: PAHs in particulate phases were collected in a pre-school (3-5 years old children) between February to April 2012 in Oporto, Portugal. Samples were simultaneously collected indoors and outdoors. Results and Discussions: PM2.5-bound PAHsranged from 0.5 to 32.4 ng/m3 for outdoor and from 0.2 to 15.4 ng/m3 for indoor ambient air. Nine possible/probable carcinogenic PAHs represented 70%, and 75% in the outdoor and indoor PM2.5 fractions, respectively. In some samples, B[a]P levels exceeded the recommended EU limit for PM fractions. PAH sources analysis identification and carcinogenic risks were also assessed. Outdoor emissions were identified as the major contributor of PAH indoors (indoor-to-outdoor ratio was lower than 1). Acknowledgements: This work was supported by IJUP project PP_IJUP2011 121. M. Oliveira and K. Slezakova are grateful to FCT for their fellowships SFRH/BD/80113/2011 and SFRH/BPD/65722/2009, respectively.

Abstract Number	**P-1-01-31**
Presenter	Woodrow Pattinson*, Peyman Zawar-Reza, Ian Longley, Simon Kingham
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Relationships between roadside and setback air quality at two nearby suburbs bisected by major motorways

Monitoring of air quality alongside heavily-trafficked motorways has shown air pollutant levels are typically much higher than levels at background monitoring sites. In many large cities, a significant portion of the population resides on land immediately adjacent to motorways. For long-term residents, this has been associated with adverse health outcomes. However, generalizing the impact of major roads on nearby air quality is complicated by local influences such as wind climate, topography and vehicle fleet emission rates. This study aimed to quantify and explain differences in pollutant levels at two roadside and several associated setback sites in Auckland, New Zealand. Levels of nitrogen oxides (NOx) and carbon monoxide (CO) were monitored over the 2010 and 2011 autumn-winter transition (April - July), around two urban motorways roughly 5 km apart. Limited monitoring of ultrafine particles (UFP) was also conducted at two sites. Annual Average Daily Traffic (AADT) was 33% greater at the primary study site (122,098) than at the secondary site (81,075). Unmonitored ultrafine particle (UFP) concentrations were modeled from NOx data using linear regression (R2>0.75). Missing CO data was predicted using nitric oxide (NO) concentrations (R2=0.93). Dispersion modeling was performed using The Air Pollution Model (TAPM) in order to assess the influence of meteorology on pollutant decay. Results show that, for both study sites, mean levels of NOx and UFPs were elevated by 41 - 52% at the roadside compared to setback sites as close as 134 m downwind. CO concentrations were elevated by 44 - 64%. Mean roadside UFP, NOx and CO at the busier study area was 25,672 pt/cm3, 128.6 µg/m3 and 1.1 ppm, respectively; higher than the lesser trafficked area by 43% (UFP, NOx) and 56% (CO). Overall results suggest that outdoor exposure along the roadside corridor is approximately 50% greater than for those living at setback distances. As New Zealand homes are particularly prone to infiltration of outdoor air, these results may have significant long-term exposure implications.

Abstract Number	**P-1-01-32**
Presenter	Jamson Masih*, Ajay Taneja
Exposure	others
Health domains	other
Type of research	others

Seasonal trends of Fine Particulate and Polycyclic Aromatic Hydrocarbons in indoor and outdoor environment at two sites in the Northern central part of India

PM1, PM2.5 and PM10 Particulate mass concentrations and twenty-three Polycyclic aromatic hydrocarbons (PAHs) were measured at urban and roadside homes of Agra, a North Central part of India. The sampling was done during winter, summer and rainy season (November 2008 - September 2009). Indoor and outdoor Particulate mass concentrations was measured by using Grimm aerosol spectrometer. PAHs were collected by using XAD-2 resin tubes (600 mg) for gaseous phase PAHs and PTFE filter paper (37 µm dia) for particulate PAHs. The individual PAHs were identified by using a gas chromatograph with mass spectrometry detector (GC/MS). At urban site the concentration of particulate matter ranged from 34 – 164.26 µg/m3 (PM1.0), 36.41 - 191.10 µg/m3 (PM2.5) and 60.93 – 320.69 µg/m3 (PM10) in indoor, whereas at outdoors the concentration ranged from 33.46-160.83 µg/m3, 38.66-179.78 µg/m3 and 85.23-272.74 µg/m3 for PM1.0, PM2.5 and PM10 respectively. The concentration range of PM at roadside site in indoor air was 67.25-151.60 µg/m3 (PM1.0), 71.45-291.14 µg/m3 (PM2.5) and PM10 mean concentration was 235.17 µg/m3. In outdoors the concentration range of PM1.0, PM2.5 and PM10 was 54.99-205.05 µg/m3, 72.31-283.36 µg/m3 and 125.27-368.74 µg/m3 respectively. The Total concentration of PAHs at urban site homes were 1430.62 ng/m3 in indoor and 975.09 ng/m3 outdoor. At roadside homes it was 1624.86 ng/m3 indoors and 2008.05 ng/m3 outdoors. Monthly and seasonal variations of coarse and fine particulate matter and PAHs have also been studied. Significant seasonal variations of particulate and PAHs pollutants were obtained using the daily average particulate concentrations. The two, three and four rings PAHs were predominantly in vapor phase while the five and six rings PAHs were primarily associated with the particulate phase. The range of B(a)P-equivalent exposure, calculated using Toxic equivalent factors (TEFs) was 14.1- 23.10 ng/m3in indoor and outdoor air. In indoor sources of PAHs were oil fumes, smoking and incense burning whereas in outdoor PAHs mainly generated from petrol and diesel combusted vehicles.

Abstract Number	**P-1-01-33**
Presenter	Annika Hagenbjörk-Gustafsson*, Kristoffer Mattisson, Ebba Malmqvist, Emilie Stroh, Lars Rylander, Håkan Tinnerberg, Bertil Forsberg, Lars Modig
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Spatial variation of ground level ozone and the relation between ozone and NO2/NOx in two Swedish cities

Background Ozone is a pollutant known to cause adverse effects on human health. It is formed by reactions between nitrogen oxides (NOx) and hydrocarbons under the influence of sunlight. In urban areas ozone is consumed oxidating nitrogen oxide (NO) to nitrogen dioxide (NO2). Despite the potential to cause adverse health effects, the local spatial distribution of ozone and the relationship between ozone, NO2 and NOx in different environments is poorly studied. Aims Our aim was to study the concentrations and spatial distribution of ozone in two cities, Malmö in the south of Sweden and Umeå in the north of Sweden, since the contribution of ozone from other parts of Europe decreases with higher latitude. We also wanted to investigate differences in the ozone/NO2 and the ozone/NOx ratios between the cities and between different environments. Methods Ozone, NO2 and NOx concentrations were measured with Ogawa diffusive samplers during three one-week campaigns in April, May/June and in August 2012. Measurements were conducted simultaneously at 20 sites in each city outside preschools, distributed at traffic sites, urban background sites and regional background (rural) sites. Results The average concentration of ozone in Malmö and Umeå were 67,5 µg/m3 and 50,6 µg/m3, respectively. The mean ozone/NOx ratio was of equal magnitude in Malmö and in Umeå, and in both cities the ratio was highest at rural sites and lowest at traffic sites. In Umeå there was a clear trend with highest ozone concentrations at rural sites and lowest concentrations at traffic sites, a trend that was not as obvious in Malmö. In Umeå the ozone/NO2 ratio at rural sites was about three times larger compared to Malmö. Conclusions There is a clear local variation of ozone, with stronger gradients in northern (Umeå) Sweden in comparison to southern Sweden (Malmö). This can partly be explained by less long-range transport of ozone and larger impact of local NO emissions that reduce ozone in northern Sweden.

Abstract Number	**P-1-01-34**
Presenter	Kate Weinberger*, Guy Robinson, Patrick Kinney
Exposure	ambient air pollution
Health domains	allergies
Type of research	exposure measurement

Spatial Variation of Ragweed Pollen Across New York City

Background: The pollen of several species in the ragweed genus (Ambrosia sp.) are clinically significant allergens with known sensitization patterns in the northeastern United States. Very little is known about how ragweed pollen varies spatially within urban areas, and whether spatial variation in pollen contributes to the development or exacerbation of allergic disease. Aims: To conduct a pilot study to determine whether there is spatial variation in the amount of ragweed pollen deposited over the course of one pollen season across New York City (NYC). Methods: In this pilot study, ragweed pollen was measured for the duration of the 2012 ragweed pollen season (August to October) at ten sites distributed across four of NYC's five boroughs. Sites were chosen from among those included in the NYC Community Air Survey on the basis of land use characteristics within 300 meter circular buffers. Five sites were chosen selecting on land use characteristics indicative of ragweed habitat, and the presence of ragweed was visually confirmed at these sites. Five sites were chosen selecting on land use characteristics inhospitable to ragweed growth. Monitoring was conducted at a uniform height relevant to human health (approximately eight feet) using passive Tauber traps modified for mounting on light poles. Results: Ragweed pollen influx ranged from 51 grains per cm2 at a site in Manhattan to 484 grains per cm2 at a site in Staten Island. The mean influx among sites where ragweed was found growing was 184 grains per cm2 (CV: 0.96), compared to 83 grains per cm2 (CV: 0.25) among sites where ragweed was not predicted to grow, although this difference was not statistically significant (unpaired t-test, p = 0.242). Conclusions: Ragweed pollen influx varies substantially across NYC locations. Spatial variation in pollen exposure could impact public health and should be studied further with saturation sampling and spatial modeling approaches that have been useful in studying combustion pollutant exposures.

Abstract Number	**P-1-01-35**
Presenter	Chane-Yu Lai*, Kai-Ling Huang, Shin-Ran Wun, Ya-Hui Lin, Po-Chen Hung
Exposure	ambient air pollution
Health domains	allergies
Type of research	exposure measurement

Study of Biological Characteristics in Wood Processing Workplace

Background: From literature review, wood processing workers were found to expose to occupational hazards and induced to have occupational asthma. The occupational hazards, for instance, include the wood dust, aflatoxin comes from Aspergillus, or endotoxin comes from Gram-negative bacteria. Aims: The study investigated the biological exposures in wood processing workplaces. Methods: An Anderson 1 stage, Anderson 6 stage bioaerosol sampler, Biosampler, AGI-30, and SKC Aluminum cyclone with polycarbonate （PC） filter were used to sample bioaerosols from two wood processing plants. In the study, SKC Aluminum cyclone was used to collect respirable sawmill wood dust. Results: In the first wood processing plant, the bioaerosol concentration in summer was higher than in other seasons. In addition, most of all, the sampled concentration during work was higher than before work. In the second wood processing plant, the total fungal concentration was higher than the total bacterial concentration. Moreover, based on the identification, the Penicillium spp., Cladosporium spp., Trichoderma spp. and Paecilomyces spp. were the dominant fungi; on the other hand, Bacillus spp. and Staphylococcus spp. were the dominant bacteria. In addition, the highest concentration of contained endotoxin was found in cultured Pantoea agglomerans, and was about 0.8053EU/m3. The Aflatoxin B1 from sawmill desorption solution had the highest concentration, and the range was 97.2~510.4 ng/g （sawmill）. Moreover, temperature and humidity for the Gram-negative bacteria was statistically significant (P<0.05). Conclusions: At present, Taiwan has no complete specification for content restrictions and exposure limit in respirable wood dust, endotoxin and mycotoxinin in workplace environment, the study recommended the related regulations should be established to prevent the increase of the occupational disease in the future.

Abstract Number	**P-1-01-36**
Presenter	Sooran Won, In-Keun Shim*, Wooseok Lee, Jinseob Kim
Exposure	others
Health domains	no health domain
Type of research	occupational study

Study of PM10 and PM2.5 indoor levels and chemical components in waiting room of bus terminal in Korea

IAQ(Indoor air quality in waiting room of bus terminal is easily influenced by a lot of inflow of external air because of frequent door opening and indoor source such as cooking process at dining room. Although people stay in a short time in bus terminal, they can be exposed by high particulate matter. In this study, we were focused on selectively large scale bus terminals that regulated by the related Korean laws. In addition, to investigate the impact of ambient air, we had monitored the outdoor air quality simultaneously. Measurement period for 7 targeted terminals was from September 2011 to July 2012 and average users per day were approximately 8,700 people. Indoor particulate matter levels were ranged 23.7~66.6 μg/m3 in the case of PM10, 12.8~56.2 μg/m3 in the case of PM2.5. This range is similar with that of outdoor. On the other hands, among all chemical components in indoor PM2.5, OC, NO3-, NH4+ were higher than those in ambient air. Indoor OC concentrations were showed higher than outdoor OC concentrations by bus and smoking emission that could be accumulated on indoor sites. Furthermore, cooking process is revealed as an additional indoor source of OC by using gases. Indoor NH3 and NOX are coming from using toilet and exhaust of vehicle. NH3 and NOX were oxidized to NH4+ and NO3- respectively. Consequently, these NH4+ and NO3- in indoor air reacted with each other and finally formed to NH4NO3. Also, Ca2+, Si, Al are recognized as markers for soil dust particles. Zn is revealed as a result of wearing process of automobile tires. Pb is explained by emissions of road dust. These high indoor anthropogenic components were suspected by inflow of outside air or re-suspensions by people's activity.

Abstract Number	**P-1-01-38**
Presenter	Sergio Bellagamba*, Federica Paglietti, Beatrice Conestabile della Staffa
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

The advantages of the data management and cartography on a monitoring in a National Priority Site

An of the most popular sites to be remediate of National Priority Site (SIN) in Italy is the city of Biancavilla (Catania), a country of about 24 000 inhabitants on the slopes of Etna, where in the last 20 years there have been about 40 deaths from mesothelioma effusion, number 10 times higher than the national average. The pollutant, called Fluoro-edenite, is a fibrous amphibole volcanic characterized by an intense yellow color and consists of very fine fibers, which determine similar pathologies asbestos-related ones. Within the town of Biancavilla, the cave of Mount Calvary has been identified as the main source of pollution because of material breach, and cultivated in this area for over 30 years until the block of mining in 2000. This remediation have provided cover with plastic film surface exposed to contamination and quarry material contaminated with uncontaminated inert material, and will provide a further coating of vegetable layer of fill. The INAIL ex-ISPESL during their operation, in cooperation with local authorities, has worked as a characterization of the environmental monitoring of air within the site of interest for the protection of personnel and the surrounding urban area . Also, the Institute has worked as a consultant for the Ministry of Environment, evaluating the feasibility and environmental requirements for providing safety of workers exposed to carcinogenic risk. In this paper, we present the advantages of a GIS, designed specifically for the National Priority Site (SIN) of the Biancavilla. Through this system, which stores data related to geographic and alphanumeric quarry Mount Calvary, and with the addition of map layers such as those on the existing administrative networks, roads and hydrography will be shown the evolutionary phases of development of safety measures Will allow to create thematic maps related to the concentration of fibers and show the time evolution of the pollution / clean-up.

Abstract Number	**P-1-01-39**
Presenter	Milena Jovaševic-Stojanovic*, Anka Cvetkovic, Snežana Matic-Besarabic, Viša Tasic, Marija Živkovic
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

TOXICITY EQUIVALENCE FACTOR AND PARTICULATE-BOUND PAHS IN THE INDOOR AND OUTDOOR AIR IN THE KINDERGARTEN IN BELGRADE (SERBIA)

Background: Many organic chemicals including particle-bound polycyclic aromatic hydrocarbon (PB-PAHs) may causes wide range of adverse health effects including inflammatory responses. There are number of studies about prenatal exposure to PAHs, but there are only a few studies about exposure of young children to PAHs in kindergartens and schools. Aim: PAHs with 2–3 aromatic rings exist dominantly in the gaseous phase, while compounds with 4 or more aromatic rings, that are more toxic, are mostly associated with PM fractions. In addition, it has been reported that PB-PAHs predominantly exists in fine particles, especially in areas with heavy traffic. The aim of this study is to identify Toxicity Equivalence Factor (TEF) of PB-PAHs against Benzo (a) pyrene (BAP) in the indoor and outdoor air in the kindergarten located at street level in the city center in Belgrade. Methods and materials: PM10 and PM2.5 were collected simultaneously in the indoor air of classroom and in outdoor air in front of the windows on a balcony of the kindergarten. Sampling was carried out in the period March-May 2010, during the weekdays only. There are no industrial sources nearby sampling site. 24-h samples were collected with the EU reference sampler using quartz filters. 16 EPA priorityPAHs were analyzed with the GCMS (Agilent 6890N with MSD). Result: Average indoor and outdoor daily mean values of PB-PAHs in PM10 were 6.79 and 8.31 and in PM2.5 4.04 and 6.32 ng/m3 respectively. Indoor and outdoor PB-PAHs expressed by TEF against BAP in PM10 were 1.10 and 1.28 and in PM2.5 0.69 and 0.93 ng/m3 respectively. Conclusions: According to the EU regulative annual limit value for PAHs in PM10 expressed by BAP is 1 ng/m3 (yearly average). During more than 40 days of sampling campaign PAHs identify by TEF against BAP exceeded 1 ng/m3 for PAHs in PM10, while there was lower than 1 ng/m3 for PAHs in PM2.5

Abstract Number	**P-1-01-40**
Presenter	Ruei-Hao Shie*, Tzu-Hsuen Yuan, Tsung-Kuan A Chou, Li-Peng Wang, Chang-Chung Chan
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Tracking air toxics at residential areas near a petrochemical complex by new real-time miniature VOC sensors

Background and aims: This study aims to use a portable and real-time volatile organic compound (VOC) sensor to track the impact of air toxics in residential areas near a petrochemical complex. Methods: We set up on-line VOC sensors at two schools, one at 0.5 km and the other at 3.0 km away from a major petrochemical complex in Taiwan, to measure refinery-related air toxics for one month. A portable and custom-made VOC sensor, MiTAP (TRICORNTECH Corp., Taiwan), was used to measure 5-minute concentrations of refinery-related air toxics continuously with a detection limit less than 1 ppb, including benzene, toluene, ethyl benzene, o-xylene, m/p-xylene, styrene, , 2-butanone, methylene chloride, methyl isobutyl ketone, vinyl acetate, methyl methacrylate, methyl tert-butyl ether, hexane, and 1,2-dichloroethane. Pollution levels measured from these two VOC sensors at 36 sectors of wind direction were used to construct pollution roses in order to assess air pollution impacts of each air toxics in the affected areas. Results: The one-month monitoring data on targeted VOCs showed that both temporal and spatial patterns are related to the emission sources and geological locations of the petrochemical complex. The 5-minute air toxics concentrations varied widely within each day and week. The diurnal patterns indicated most air toxics were related to industrial emissions rather than traffic emissions. Pollution roses showed downwind air toxics concentrations were higher than other wind directions, with particularly high at wind speeds of 6-8m/s. The pollution rose analysis with 5-minute concurrent measurements revealed the impact of emission sources on air toxics levels in the vicinity of this complex, which had not been well documented by traditional monitoring method in the past. Conclusion: This study concluded that pollution roses based on the new real-time high-precision VOC monitoring device, MiTAP, can be used to investigate source contributions to air toxics pollution surrounding industrial complexes.

Abstract Number	**P-1-04-01**
Presenter	Stefani Penn*, Saravanan Arunachalam, Neil Davis, Kevin Talgo, Darcy Zarubiak, Jonathan Levy
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A comparison between monitoring and dispersion modeling approaches to assess the impact of aviation on concentrations of black carbon and nitrogen oxides at LAX

Aircraft activity and airport operations can increase combustion-related air pollutant concentrations, but it is difficult to distinguish aviation emissions from traffic and local sources. Emissions inventories are uncertain and dispersion models may not capture aircraft plume complexity; ambient monitoring data require detailed statistical analysis to extract aviation signals. The goal of this study is to understand differences between two source attribution approaches, informing improvements to both and allowing quantification of aviation impacts on air quality. In this study, NOx and BC were measured in July 2008 at LAX. We constructed regression models to predict concentrations as a function of meteorology, flight activity, and diurnal patterns. For receptors corresponding to monitor locations, we used the EDMS/AERMOD system to determine marginal contributions of airport operations to ambient concentrations. We compared 1-hour average source-specific predictions, considering bias and strength of correlation, and examined diurnal patterns. Departures on runway 25R contributed the majority of BC and NOx at the nearest monitoring site, with pre-departure increases in all models, indicative of influence from runway/taxi activity. There was poor correlation (BC R2<.02; NOx R2<.10) between hourly predictions by model, with systematic bias differing by pollutant (BC dispersion/regression =.20; NOx =.84) and varying by time of day. 36% of NOx data displayed less than a factor of 2 difference between approaches. Compared to the regression model, AERMOD vastly overpredicted NOx between 11pm-2am, and underpredicted 54% of NOx by more than a factor of 2 versus 91% under for BC. Our comparison helped us determine possible areas of improvement for EDMS/AERMOD, including emissions inventories for BC, NOx speciation factors used in EDMS, near-field dispersion that considers treatment of buoyant jet exhaust, NOx chemistry module, and meteorological behavior during overnight hours.

Abstract Number	**P-1-04-02**
Presenter	Lars Modig*, Annika Hagenbjörk-Gustafsson, Magnus Strömgren, David Olsson, Lennart Jonsson, Pernilla Almerud, Bertil Forsberg
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A Land Use Regression model for predicting concentrations of benzene and 1,3-butadiene accounting for small scale biofuel burning

BackgroundTraffic is often the most important emission source for ambient air pollution in urban areas, although other sources locally can be at least as important. Small scale biofuel burning emits a wide range of air pollutants, of which many are also substances in vehicle exhaust. AimThis study aimed to develop a Land Use Regression model (LUR) to predict concentrations of benzene and 1,3-butadiene, accounting for emissions from both traffic and burning of biofuels. MethodsYearly average concentrations of benzene and 1,3-butadiene were estimated from diffusive monitoring at 39 sites during three weekly measuring periods in 2011. The majority of sampling sites were placed in areas with high density of biofuel stoves and boilers, based on information from the chimney sweeper's registry. A large number of geographical variables were collected quantifying the area of land use, population density, traffic and heating equipment surrounding each measuring site. This information was later combined in a regression model, to explain the geographical variation in the measured levels. ResultsThe estimated yearly average concentration of benzene was 0.78 µg/m3, ranging from 0.40 to1.33 µg/m3. The corresponding concentration of 1,3-butadiene was 0.10 µgm3, ranging from 0.06 to 0.20 µg/m3. For benzene, the final LUR model explained 75% (adjusted r2) of the variation (cross validation (CV) 69%) and included five variables, of which two referred to traffic and one to the number of pellet boilers within 100 meters. The final 1,3-butadiene model explained 56% of the variation (CV 37%) and contained five variables of which three referred to biofuel burning. In both models an increasing number of pellet boilers within 100 meters were associated with higher levels of benzene and 1,3-butadiene. Conclusion This study show that benzene and 1,3-butadiene can be predicted with reasonable precision using geographical information, and that small scale biomass burning is an important predictor variable.

Abstract Number	**P-1-04-03**
Presenter	Stuart Batterman*, Rajiv Ganguly, Vlad Isakov, Michelle Snyder, Thomas Robins, Toby Lewis, Paul Harbin
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

A new approach for maintaining anonymity and enhancing robustness of model-based personal exposure estimates

BACKGROUND Dispersion models can be used to derive spatially- and temporally-resolved exposure metrics for epidemiological studies, potentially reducing exposure misclassification and improve the ability to identify associations with health outcomes. However, dispersion modeling requires detailed information on locations of study participants. This information is not publicly available because identities of study participants must be protected for legal and ethical reasons. AIMS The paper evaluates an approach to provide information on locations of study participants for dispersion modeling, while maintaining anonymity and improving the robustness of predictions. METHODS The Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS) is investigating roadway exposures of air pollutants and respiratory effects in children with asthma who live near major roads in Detroit, Michigan. Children's residence locations were represented using ‘mini-grids' consisting of a rectangular receptor grid on 50 m centers placed near each home. Results from several interpolation techniques were compared to dispersion model predictions at the home locations. A sensitivity analysis identified typical and maximum errors and key variables affecting performance. RESULTS Depending on the number of receptors used, minigrids gave anonymity to 50 or 100 m, a distance sufficient to protect participants' identify. Linear interpolations produced positive biases and relative errors up to 40% near roads (<50 m); errors were <10% at larger distances. Non-linear interpolations reduced the bias and relative error. CONCLUSIONS The minigrid approach anonymizes the location of study participants and averaging enhances robustness since locations (residences, playgrounds, building air intakes) span an area and cannot be specified to very small region. The approach can increase the feasibility and potentially the representativeness of exposure predictions used in epidemiological studies.

Abstract Number	**P-1-04-04**
Presenter	Kazuhiko Ito*, Randall V. Martin, Aaron van Donkelaar, Shailesh Kharol, Jeffrey Brook
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

An application of satellite-based surface air quality estimates to evaluate city-to-city variation in short-term effects of PM2.5 on morbidity and mortality

Background: Recent advancement in satellite remote sensing has allowed estimation of ground-level concentrations of fine particles (PM2.5) and nitrogen dioxide (NO2) in locations where no ground monitors exists. We hypothesize that the observed heterogeneity in PM2.5 short-term risks across cities is explained by variation in NO2, an indicator of combustion sources. Cooper et al. recently proposed a satellite-based multi-pollutant index (SATMPI) that scales local PM2.5 concentration by its NO2 concentration (doi:10.1021/es302672p) partially based on this hypothesis. Aims: To investigate feasibility of using satellite-based air pollutant measurements to explain the city-to-city variation in PM2.5 risk estimates for morbidity and mortality. Methods: We conducted a random effects second-stage analysis to model lag 0 day PM2.5 risk estimates for elderly cardiovascular hospitalizations (2000-2008) and all-cause mortality (2001-2006) from the time-series analysis of 148 U.S. cities in the National Particle Component Toxicity project as a function of city-to-city variation in satellite-based estimation of NO2, PM2.5, and SATMPI. NO2 data from ground monitors were available for only 95 cities, but satellite-based NO2 was available for 148 cities. The influence of the satellite-based air pollutant was expressed as a percent change in the risk estimate, per its inter-quartile-range (IQR), from the combined estimate without predictors. Results: The satellite-based NO2 was a positive predictor of city-to-city variation in PM2.5 cardiovascular hospitalization risk estimate with a 42.9% increase (95% confidence interval: 0.0, 85.8) per IQR change. Satellite-based PM2.5 and SATMPI resulted in similar magnitude of impact with less significance. The satellite-based indices on mortality risk estimates showed similar magnitude of impacts with even less significance. Conclusion: Satellite-based air quality indices that combine PM2.5 and NO2 may be useful for health effects studies.

Abstract Number	**P-1-04-05**
Presenter	Michelle Snyder*, Saravanan Arunachalam, Vlad Isakov, David Heist, Janet Burke, Sarah Bereznicki, Kathie Dionisio, Stuart Batterman, Paul Harbin
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Applying Multi-scale Air Quality Models to Support Epidemiologic Studies

Background The Near-road EXposures to Urban air pollutant Study (NEXUS) investigated whether children with asthma living in close proximity to major roadways in Detroit, MI have greater health impacts associated with air pollutants than those living farther away, particularly near roadways with high diesel traffic. Air quality modeling provides exposure estimates for examining relationships between traffic-related air pollutants and adverse health outcomes. We use measurements collected at a subset of participant homes for model evaluation. Aims We hypothesize that refined concentration estimates from multi-scale air quality models will provide improved exposure estimates for investigating associations with health outcomes, particularly for traffic-related pollutants that can vary considerably over short distances and time scales. Methods Local-scale dispersion models (RLINE and AERMOD) have been applied with locally- and temporally-resolved emissions inputs to determine mobile and stationary source impacts on air quality at NEXUS participant locations. These estimates are combined with background estimates (CMAQ and a kriging based) to construct exposure metrics for epidemiologic analysis. Results Models provide hourly concentrations at each of the NEXUS locations for multiple pollutants (CO, NOx, PM25, and EC) for 2.5-year period. Model results were compared with measurements taken at participant locations and show similar spatio-temporal patterns; including elevated EC for high diesel and elevated CO for high traffic. The results are consistent with the study design identifying various exposure zones (low traffic, high traffic/ low diesel, and high traffic/ high diesel). Conclusions A multi-scale modeling approach can complement measurements to provide spatially- and temporally-resolved air quality estimates to support acute health studies. These models capture time-series and source-specific features needed to support individual level epidemiologic studies.

Abstract Number	**P-1-04-06**
Presenter	Yael Etzion*, David M. Broday, Barak Fishbain
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Assessing exposure to ambient air pollution at the urban temporal scale by analysis of image color and effective bandwidth

Airborne particulate matter (PM) attributes have a key role in assessing its health effects, since exposure to PM, especially the fine particle fraction (with diameter smaller than 2.5 µm, PM2.5), has been associated with adverse effects such as cardiovascular and respiratory diseases. PM2.5 has also longer atmospheric residence time in comparison to the coarser fraction (PM2.5-10), which increases its potential exposure risk. It is therefore important to monitor PM2.5 spatiotemporal variations near the ground at an urban-scale resolution. Satellite remote sensing is a common approach for gathering spatiotemporal data regarding aerosol events but its current spatial resolution is limited to a relatively large grid that does not fit highly varying urban conditions. Moreover, satellite-borne remote sensing has limited revisit periods and it measures along vertical atmospheric columns. Thus, linking satellite-borne aerosol products to ground PM measurements is still extremely challenging. In the last two decades, visibility analysis of horizontal imaging is used by the US Environmental Protection Agency (US-EPA) to obtain quantitative representation of the air quality in rural areas. Significantly fewer efforts have been given to utilize the acquired scene characteristics (color, contrast, etc.) for quantitative parametric modeling of PM concentrations. We suggest utilizing the image effective bandwidth, a quantitative measure of image characteristics, for predicting PM concentrations. For validating the suggested method, we have assembled a large dataset that consists of time series imaging as well as measurements from air quality monitoring stations located in the study area, that report PM concentrations and meteorological data (wind direction and velocity, relative humidity, etc.) Quantitative and qualitative statistical evaluation of the suggested method shows that dynamic changes of PM concentrations can be inferred from the acquired images.

Abstract Number	**P-1-04-08**
Presenter	Jin Ki Eom*, Duck Shin Park, Keun Yul Yang, Kiyoung Lee, Ki Chul Cho
Exposure	others
Health domains	healthrelated quality of life
Type of research	others

Daily Activity Patterns and Time Spent for Exposure Assessment:

Recently in the field of personal exposure studies, the individual daily activity and time spent have been greatly concerned. The information about daily activity and time use patterns provide benefit on the analysis of environmental pollutant within microenvironment. Comprehensive studies for daily activity with time spent as a basis for estimates of personal exposure have been conducted few times in Korea. The primary objective of this research, therefore,is to present activity patterns and time spent of individuals especially for University students. University campus is unique area where students decide activities and spend time respect to them on campus. This activity and time spent will be a basis of estimating number of activity population by time of day at a certain building or place on campus. Activity population estimated will help to assessment individual exposure in micro-environmental pollutants. The Dongnam University conducted a student activity survey. A random 500(10%) students, sample of students representing the total Dongnam University student population, was selected and they were asked to complete a activity diary for one school day between April 4 and 30, 2012. The questions included demographic information and activity-time use patterns. The activities consist of 7 major classifications: Work(class, lab, etc), Study(personal), Excise, Recreation, Club, Other, and Travel. We focus on the school hours from 6AM to 24PM and present the statistics of activity frequency, duration, and travel time by activity patterns. Further, based on the activity-time spent data, we develop activity profile by hourly segmentation at individual building level on campus and construct a statistical model for estimating activity profile. This will be basis of estimates of activity population for exposure at environmental pollutant. Findings will indicate whether theactivity-time spent estimates have great potential of personal exposure studies with indoor pollutant.

Abstract Number	**P-1-04-09**
Presenter	Duanping Liao*, Eric Eric Whitsel, Gregory A. Wellenius, Richard Smith, Adam Szpiro, Brent A. Coull, Jeff Yanosky
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Daily kriging to estimate large scale location specific PM10 – comparisons of measurement error options

Background: We have previously used kriging from ArcGIS to estimate daily ambient PM at geocoded locations in large population-based studies (EHP 2006 114:1374-1380). A new version of ArcGIS (v10) is now available and it implements measurement error kriging, a method not available in earlier versions, as the default method. Aims: We compared the performance and cross-validation measures of different versions of ArcGIS to assure the consistency of our PM estimates. Methods: Krigings were performed to estimate PM10 concentrations on May 18, 2000 at approximately 95,000 locations within contiguous US using 1040 PM10 measures from US EPA Air Quality System monitors. Results: The semivariogram cross-validation measures are similar, with the prediction errors of -0.1960 and -0.2285 from ArcGIS 8 and 10, root mean squares standardized of 1.197 and 1.233, and standardized prediction errors of -0.032 and -0.015, respectively. However, the location-specific estimated PM10 are different, with the mean estimated PM10 [prediction standard error, PSE] of 30.07 [13.27] and 28.71 [4.66] (µg/m3) from v8 and v10, respectively. The mean PSEs from v8 and v10 are significantly different ($p < 0.001$). The concordance correlation coefficient of estimated PM10 is 0.98, in contrast to 0.09 for PSE. ArcGIS 10 performed virtually identical to earlier versions if not using measurement error option. Conclusions: The PSE in measurement error kriging was systematically and significantly smaller because the method assumes that the differences in PM10 measured at co-located or nearby monitors are solely attributable to measurement error. However, since there are very few or no regulatory pollutant monitors that are truly co-located, measurement error kriging may over attribute the real local spatial variability to measurement error, and may therefore yield optimistically precise estimates of ambient pollutants like PM10. In sum, the use of measurement error kriging may not be appropriate in the setting of spatial-temporal models of ambient pollutants.

Abstract Number	**P-1-04-10**
Presenter	Robert Tang*, John Gulliver, Marta Blangiardo
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Developing intra-urban land use regression air pollution models with enhanced geographical variables

Background Land use regression (LUR) modelling has been widely used to provide long term exposure assessments of air pollutants for epidemiological studies. Quite often LUR models lack variables on site characteristics such as street canyons and building densities, which may affect the dispersion environment, as air pollutants can be trapped by buildings, especially where continuous street canyons are found with high buildings (e.g. urban centres). Aims To improve LUR models, and characterisation of local pollution microenvironments, using 'enhanced' geographical variables extracted from newly available city-wide datasets on building heights and geometry. Methods Models were developed for NOX, NO2 and PM10 for 2008-2011 for London, UK. A separate set of models, which only used 'traditional' land use and traffic indicators (e.g. traffic intensities and distances from road), were also developed and compared with the enhanced models. Results Considerable improvements to performance were seen in enhanced NOX and NO2 models compared to corresponding traditional ones (26.8% and 15.3% increase in adjusted R2, and 24.2% and 22.2% decrease in RMSE for NOX and NO2 respectively). Some improvements were found for PM10 (4.8% increase in adjusted R2 and 7.1% decrease in RMSE). New geographical variables provided greater levels of improvements for NOX and NO2, which was expected as these have higher proportions of local air pollution than PM. A new variable developed from building area × building height within 50m explained highest levels of spatial variability for NOX and NO2. Conclusions This study demonstrated that enhanced geographical datasets can provide substantial improvements to model capabilities, in particular predictions of pollutant spatial variability at road- and kerb-side locations for traffic-related pollutants. This may help to reduce exposure misclassification in epidemiological studies and merely improve estimation of health risks.

Abstract Number	**P-1-04-11**
Presenter	Matthew Simon*, Alex Bob, Allison P Patton, Doug Brugge, John L Durant
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Effectiveness of a fixed-site CPC in capturing representative PNC levels across an epidemiological study area

Background: Epidemiologic studies often use spatially-fixed sites to monitor air pollution to test associations with changes in health measures. Relatively little work has been done to compare the variation of fixed-site PNC monitors across broad urban areas for use in such studies. Central-site measurements of particle number concentrations (PNC) are rarely validated by comparisons to PNC at other sites across study areas. Aims: The aim of this work was to compare PNC data collected at the Massachusetts Department of Environmental Protection (MassDEP) monitoring station in Roxbury (MA, USA) to short-term fixed sites within a study area that contains the MassDEP station. Methods: A study area covering ~45 square kilometers in Boston was selected based on residences in the Boston Puerto Rican Health Study. PNC was measured at MassDEP each minute from December 2011 – February 2013. Between May 2012 and February 2013, one-minute interval PNC was also measured at six residences (two residences at a time), each for six weeks. Results: PNC at the central site was weakly correlated with data collected at the residences (Spearman correlations between residences and central site: median = 0.35, range = 0.18-0.49). PNC time series plots show times of high and low PNC across sites generally agreed between the sites; however, the amplitude of the peaks and troughs vary by site location as expected. Conclusions: Based on the data collected and analyzed thus far, collecting air samples with a single, fixed-site CPC does not provide a complete representation of the PNC profile across this study area in Boston. Additional monitoring is probably needed to capture the variation in PNC levels to develop accurate exposure models for the study area.

Abstract Number	**P-1-04-12**
Presenter	Inmaculada Aguilera*, Xavier Basagaña, María Teresa Pay, David Agis, Laura Bouso, Maria Foraster, Marcela Rivera, José María Baldasano, Nino Kuenzli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Evaluation of the CALIOPE air quality forecasting system for epidemiological research: the example of NO2 in the province of Girona (Spain)

Background: Air quality models are being increasingly used to estimate long-term individual exposures to air pollution in epidemiological studies. Most of them have been evaluated against measurements from a limited number of monitoring stations, which may not properly reflect the exposure characteristics of the study population. Methods: We evaluated the performance of the Spanish CALIOPE air quality forecasting system (with a spatiotemporal resolution of 4 km x 4 km and 1 h) over 884 monthly passive measurements of NO2 conducted at 635 outdoor locations across the Girona province over one year. Average NO2 modelled concentrations were derived for all measurements conducted during the same sampling campaign at all the sampling sites located within the same grid cell. In addition, the ratio between measured and modelled concentrations for the whole study period at an urban background monitoring station was used to reduce model underestimation. Results: The correlation coefficient (r) between measured and modelled concentrations for the entire study area (which includes urban settings, inland and coastal towns, and rural areas) was 0.78. After correcting the modelled concentrations by the measured to modeled ratio at the fixed station (ratio=0.25), they exhibited a high agreement to the measured concentrations (27.7 µg/m3 and 29.3 µg/m3, respectively). The root mean square error (RMSE) showed an urban-rural pattern in model performance, being higher at urban areas (11.3 µg/m3) and lower at rural areas (6.7 µg/m3). These differences on the model performance by type of subarea were affected by sub-grid emission sources. Conclusions: CALIOPE system is a valuable tool to complement study-specific air pollution measurements by incorporating regional spatial variability, as well as short- and long-term temporal variability. For epidemiological research, output data from air quality models should be preferably evaluated against measurements at locations which represent the exposure distribution among the study population.

Abstract Number	**P-1-04-13**
Presenter	Sandra Johannesson*, Magnus Akerstrom, Kerstin Bergemalm-Rynell, Bo Strandberg, Gerd Sallsten
Exposure	organic compounds
Health domains	cancer
Type of research	exposure measurement

Exposure to benzene, toluene, xylenes and naphthalene in the general population of Gothenburg

Background and aim: Benzene is classified as a human carcinogen (IARC, group 1), naphthalene is considered a possible human carcinogen (IARC, group 2B). Toluene and xylenes affect the central nervous system at high exposures, but are not classified as carcinogens. All substances originate from various combustion processes, e.g. traffic, industry, wood smoke and cigarette smoke. The aim was to measure personal exposure, indoor and outdoor levels of these air pollutants in the general population. Methods: Personal exposure along with indoor (bedroom), and residential outdoor concentrations of benzene, toluene, xylenes and naphthalene were measured for 37 randomly selected adults in Gothenburg, Sweden. Repeated sampling was performed for 20 of the study participants, and each sampling period was 7 days. The diffusive sampler Perkin-Elmer with Tenax TA was used, and analysed with ATD-GC-MS. Results: Median personal exposure to benzene, toluene, xylenes and naphthalene was 0.7; 6.9; 4.7 and 0.2 µg/m3, respectively. Personal exposure was significantly higher than outdoor levels for all substances, and indoor concentrations were significantly higher than outdoor levels for toluene, xylenes and naphthalene. Personal exposure was highly correlated with indoor levels for all compounds. The between-person variance component dominated the total variability for personal benzene and toluene, whereas the within-person variance dominated for naphthalene. For personal exposure to xylenes, the variance components were approximately equally partitioned. Between-home variances dominated for indoor concentrations, while essentially all the variability in outdoor levels was attributable to day-to-day variances. Conclusions: The median personal exposure to benzene was below the Swedish health-based guideline value of 1.3 µg/m3. Personal exposures to toluene, xylenes and naphthalene were well below the guideline values suggested by the EU INDEX project.

Abstract Number	**P-1-04-14**
Presenter	Yuli Huang*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Frequency, duration and concentration of intermittent exposures to ambient air pollutants at elevated levels

Background: Various health effects are known to be affected by ambient air pollution. Despite continued efforts on improving ambient air quality, the anticipated benefit on health effects did not seem to coincide. Some of the adverse effects with air pollutants may be induced by acute exposure to high concentrations, but the occurrence and long-term trends of such exposure events have not been well characterized. Aims: To describe high air pollution events with respect to event frequency, duration and level for better exposure characterization. Methods: Historical data were obtained from a local air quality monitoring station, and daily concentrations for particulate matter (PM10) were calculated. Various screening values were used to define high pollutant levels. Any consecutive days with concentration above the screening level were considered the same event. For each event, the total length (in days), average concentration and maximum concentration were extracted. Probability distributions were calculated for event occurrence, event duration as well as cumulative exposure levels. Further, lag times between two air pollution events were recorded for comparison. Results: Six years of monitoring data were obtained for this analysis (n = 2,104). The daily PM10 concentration exceeded 125 mcg/m3 257 times, yielding occurrence probability of 0.12. The duration for each event ranged from 1 to 7 days and averaged 1.96 days. For each event, the cumulative exposure level ranged from 125.08 to 1187.88 mcg/m3-day. Substantial variation was also found in length between two air pollution events, ranging from 1 to 40 days in dry season and up to 199 days in rainy seasons. The annual average concentration decreased in the last two years, and air pollutant events occurred at a lower frequency and lasted for shorter time, however, the effects were more likely due to increase rain days. Conclusions: Exposure to elevated air pollutants may be considered intermittent events and should be considered when evaluating for potential impacts on human health.

Abstract Number	**P-1-04-15**
Presenter	Evi Dons*, Martine Van Poppel, Bruno Kochan, Geert Wets, Luc Int Panis
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Implementation and Validation of a Modeling Framework to Assess Personal Exposure to Black Carbon

In order to estimate exposure to air pollution of individuals in a population more accurately, we developed a personal exposure modeling framework. Because people tend to move from one place to another during the day, their exposure will be determined by the concentration at each location combined with the exposure encountered in traffic. The modeling framework is built and validated for Black Carbon (BC) in Flanders (Belgium), but could be applied to other pollutants and study areas when providing the right input data. Exposure to BC in different ‘fixed’ microenvironments is assessed by using hourly land use regression models, combined with an indoor/outdoor factor for exposure in indoor environments. To estimate BC exposure in transport, we developed a separate model taking into account transport mode, timing of the trip and degree of urbanization (Dons et al., 2013). An activity-based traffic model was used to model the whereabouts of individual agents. The modeling framework is validated using weeklong time-activity diaries and BC exposure as revealed from a personal monitoring campaign with 62 participants (Dons et al., 2011, 2012). Because we wanted to validate the complete chain including the activity-based model, we did not simply use the revealed diaries for the validation. For each participant in the monitoring campaign, we made up a synthetic population of 100 model-agents with all agents having the same characteristics as each real-life agent (age, gender, work status, number of children in the household, number of cars in the household, subzone of the home address, etc.). When these model-agents pass through every stage of the modeling framework; this results in a distribution of potential exposures for each individual. Results of this validation will be presented. We want to use the modeling framework in the future to assess exposure of the Flemish population, or subgroups of the population, e.g. low socio-economic class vs. high socio-economic class, women vs. men.

Abstract Number	**P-1-04-16**
Presenter	Xavier Basagaña*, Inmaculada Aguilera, Marcela Rivera, David Agis, Maria Foraster, Jaume Marrugat, Roberto Elosua, Nino Kuenzli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Measurement error in epidemiologic studies of air pollution based on land use regression models

Background: Land use regression (LUR) models are increasingly used to estimate air pollution exposure in epidemiological studies. These models use air pollution measurements at a small set of locations and modeling based on geographical covariates that are available at all study participant locations. When LUR model predictions are used as explanatory variables in a model for a health outcome, measurement error can lead to bias of the regression coefficients and to inflation of their variance. In previous studies dealing with spatial predictions of air pollution, bias was shown to be small while most of the effect of measurement error was on the variance. The particular case of LUR predictions has not been studied in detail. Aims: To study the consequences of using LUR-based estimates of air pollution exposure in models for a health outcome. Methods: We used simulations based on real data from a study investigating the association between chronic exposure to traffic-related air pollution and subclinical atherosclerosis. Attenuation factors were computed as the ratio between the estimated coefficient and its true value. We examined attenuation for scenarios resulting from combinations of: R2 of LUR model of 75% and 50%; number of air pollution measurements to build the LUR model: 20, 40 and 80; number of available predictors to build the LUR model: 20 and 100. Results: When the LUR model had an R2 of 75%, attenuation ranged from 0.43, with 20 air pollution measurements and 100 candidate predictors, to 0.90, with 80 measurements and 20 candidate predictors. Attenuation was stronger when the R2 of the LUR model was 50%, ranging from 0.23 to 0.80. Conclusions: In realistic cases where LUR models are applied to health data, bias of health effect estimates can be substantial. This bias depends on the number of air pollution measurement sites, the number of available predictors for model selection, and the amount of explainable variability in the true exposure.

Abstract Number	**P-1-04-17**
Presenter	Kees de Hoogh, Yutong Cai*, Susan Hodgson, Marta Blangiardo, John Gulliver, Anna Hansell, Paul Elliott
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Methods to harmonise air pollution and noise assessment in EU Biobanks

Background and aims: Biobank Standardisation and Harmonisation for Research Excellence in the European Union (BioSHaRE-EU) is a FP7 funded project that aims to develop methods and tools to enable researchers to use standardised, pooled data from different biobanks. Within this project we are developing methods to harmonise noise and air pollution exposures in European biobank studies to examine their relative contributions to cardio-respiratory health. Methods: Air and noise pollution exposures will be modelled at home address using the same standardised procedures for each biobank. Air pollution exposures will be estimated using the ESCAPE Land Use Regression (LUR) method and noise exposures using the UK's Calculation of Road Traffic Noise (CRTN) method. Associations between exposure and prevalence of respiratory and cardiovascular events will be examined using Bayesian statistical methods: i) joint assessment of the effect of the two exposures, ii) modelling differences and communalities across countries taking into account uncertainty, iii) quantification of the measurement error bias in the exposures. Results: 317,000 addresses from HUNT (Norway), 323,890 from Lifelines (Netherlands) and 38,941 from EPIC-Oxford (UK) biobanks have been successfully geo-referenced. Agreement to geo-reference 500,000 addresses from UK Biobank has been reached. The next step is to model and assign estimates of air and noise pollution exposures at home address. Exposure characteristics of cohort participants will then be compared with nationally available population exposures such as European Union Noise Directive maps and national air pollution assessments. Conclusions: The pooling of standardised data from established cohorts offers the very large sample sizes needed to investigate environmental influences on multifactorial diseases. Development of such methods to harmonise environmental exposures across biobanks will help in environment-environment and gene-environment studies.

Abstract Number	**P-1-04-18**
Presenter	Pasi Lipponen*, Otto Hänninen, Riikka Sorjamaa, Monica Gherardi, Maria Pia Gatto, Andrea Gordiani, Angelo Cecinato, Paola Romagnoli, Claudio Gariazzo
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

PAH indoor-to-outdoor relationship and exposure levels in Rome

PAH indoor-to-outdoor relationship and exposure levels in Rome Background. Polycyclic aromatic hydrocarbons (PAHs) are known to be harmful to human health. Spatial variability of the emissions, atmospheric dispersion, infiltration of the particles from outdoor to indoors, and population time-activity defines the exposures. Since the time spent inside is typically 80-90% (followed by time spent in traffic and outdoors), indoor exposures and thus particle infiltration from outdoors is a key issue. Aim. The aim of the work is to study the indoor-outdoor (I/O) relationship of PAH concentrations between non-heating and heating periods in different microenvironments (homes, schools, offices and traffic), and to estimate the population exposure levels in different seasons. This work is a part of the on-going Life+ EXPAH project. Methods. The current work uses PM2.5-bound PAH concentration measurements carried out in Rome, Italy, as an input data. The I/O relationships of PAHs are evaluated and entered to a mass-balance model in order to capture the indoor sources. Exposure levels are estimated by using population time-activity data and PAH concentrations in different microenvironments. Results. High, up-to 30-40 fold differences in outdoor PAH concentrations were observed between non-heating and heating seasons. I/O ratios of PAH concentration between different microenvironments were noticed to vary much less, but between different seasons the variation of I/O ratios was significant. Indoor sources played only a minor role in PAH exposures. Noticeably, although PAHs are associated to PM2.5, the correlation between the corresponding burdens in the indoor air looks low combining the winter and summer data. Conclusions. Residential heating emissions contribute almost 90% of the PAH exposure yearly in Rome metropolitan area followed by traffic and waste incineration. The variation in the PAH indoor-outdoor relationship is significant between different seasons, but there is only little variations between different microenvironments.

Abstract Number	**P-1-04-19**
Presenter	Dikaia Saraga*, Krystallia Kalimeri, John Bartzis
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Personal exposure to ambient and indoor ozone: the effect of different commuting modes in Athens, Greece.

Background. Epidemiological studies have shown that commuting in traffic is associated with adverse health effects and consequently, it is vital to investigate commuters' exposure to traffic-related air pollutants as ozone. To the best of our knowledge, few relative studies have been conducted in Greece. Aims. The present study aimed at monitoring the -residential and office- indoor, outdoor and personal levels of ozone for people living, working and commuting in Athens. The effect of using different means of transportation will be discussed. Methods. Seventeen people working in the same place (National Center for Scientific Research "Demokritos", situated in a suburb of Athens) participated in the study. Volunteers used one or more different means of transportation: bus, train, metro, suburban rail, car and walking. For each volunteer, residential (indoor and outdoor), office (indoor and outdoor) and personal (breathing zone) concentration of ozone have been measured for a period of five working days, using passive samplers (Radiello). The time scheduled and detailed activities for each volunteer have been recorded in questionnaires. Results. Preliminary results do not indicate any limit exceedance (Directive 2008/50/EC: 120μg/m3, WHO Air Quality Guidelines 2005: 100μg/m3). Ozone levels from personal samples ranged between <MDL and 11μg/m3, while residential ozone concentration ranged from 0.40 to 14.1 μg/m3 indoors and from 26.1 to 54.2 μg/m3 outdoors. Outdoor ozone concentration in volunteers' common working environment was in average 49.3±9.7μg/m3, while the corresponding indoor (offices and laboratories) was in average 11.2±8.1μg/m3. Conclusions. Results analysis will focus on each volunteer's levels measured versus the time spent indoors (in each microenvironment), outdoors and while commuting. A discussion on the potential parameters (selected mean of transportation, selected root, area of living etc) contributing to exposure to ozone will be presented.

Abstract Number	**P-1-04-20**
Presenter	Angeliki Karanasiou*, Xavier Querol, Andrés Alastuey, Cinzia Perrino, Jesus de la Rosa, Giovanna Berti, Begoña Artiñano, Jordi Sunyer, Francesco Forastiere, Massimo Stafoggia, Med-Particles Study Group
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

PM components and sources across Mediterranean countries: Results from the Med-Particles project

Background: The Mediterranean Basin, MB is characterised an air pollution hotspot, located at a crossroad of air masses coming from Europe, Asia and Africa. The large variety of aerosol sources coupled with complex orography and atmospheric dynamics gives rise to a complex mixture of gaseous and particulate matter (PM) pollutants that merits further investigation. Aim: The aim of this study is to investigate the long-term trends of air pollutants in the Mediterranean Basin. Specific emission sources were investigated in order to assess their impact on urban air quality. Methods: In the framework of the Med-Particles project ambient concentrations of PM2.5, PM10, gaseous pollutants and also chemical components were collected from traffic and urban background sites in MB countries: Spain (Barcelona, Madrid, Huelva), France (Marseille), Italy (Rome, Turin, Bologna, Milan) and Greece (Athens, Thessaloniki) for the period 2001-2010. Source apportionment analysis was conducted by the receptor model Positive Matrix Factorization, PMF. Results and Conclusions The long-term trends of PM10 and PM2.5 and gaseous pollutants as SO2 and CO2 show a decreasing trend for all the traffic sites in the MB despite the important variability of the concentration values. This decreasing trend is attributed to the effectiveness of the vehicular emission control strategies that have been implemented in Europe, the improvement in motor engine characteristics and fuel composition but also to the economic crisis that caused a reduction in fuel consumption. Source apportionment analysis by PMF provided the main sources for PM2.5 and PM10, namely, road dust, secondary aerosol (sulphate and nitrate), vehicle emissions, soil, marine aerosol, biomass burning, and minor industrial emission. Among these sources, the mineral source (road dust and soil) is the major contributor to PM10, up to 40% of its mass concentration, while for fine particles traffic and secondary aerosol are the main sources contributing 25% and 30% correspondingly to the PM2.5 mass concentrations.

Abstract Number	**P-1-04-21**
Presenter	Hassan Amini*, Seyed Mahmood Taghavi Shahri, Sarah B. Henderson, Kazem Naddafi, Ramin Nabizadeh, Masud Yunesian
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Predicting seasonal and spatial patterns of long-term nitrogen oxides concentration in Tehran, Iran using land use regression

Background: Tehran, the capital city of Iran in the Middle East, experiences extreme air pollution concentrations. Aims: Long-term spatial and seasonal patterns of nitrogen oxide (NO), nitrogen dioxide (NO2) and nitrogen oxides (NOx) concentrations were estimated by land use regression (LUR). Methods: Hourly measurements of NO, NO2 and NOx were obtained from 23 automatic air pollution monitoring stations spread across the metropolitan area of Tehran. In addition, 210 variables were compiled using a Geographic Information System. Finally, annual and seasonal models (cooler and warmer season) were built using multiple linear regression with a novel step-by-step algorithm. Results: The annual mean concentrations of NO, NO2 and NOx were 88.1, 53.1, and 141.8 ppb, respectively. The cooler season mean concentrations were 117, 20, and 180.2 ppb, respectively and the warmer season mean concentrations were 60, 44.6, and 104.7 ppb, respectively. The leave-one-out cross-validation (LOOCV) R2 values for the LUR models ranged from 0.50 to 0.84 for NO, from 0.59 to 0.69 for NO2, and from 0.70 to 0.77 for NOx. The most predictive variables for NO included measures of distance to traffic, while those for NO2 and NOx were more influenced by industrial sources. Conclusions: Resulting models and maps show that patterns were consistent for the annual and cooler season models for NO, NO2 and NOx, but there were clear differences for warmer seasons.

Abstract Number	**P-1-04-22**
Presenter	Bonnie Gaborek*, Debbie Lander
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Rapidly Predicting Ambient Air Concentrations to Volatile Organic Compounds Diffusing from Polymeric Materials in Indoor Storage Facilities

After manufacture, polymeric materials sometimes contain residuals of volatile organic compounds (VOCs) that diffuse over time from the products into the ambient air. When large quantities of polymeric products are stored, VOCs may potentially produce a risk to people exposed to them. Protecting individuals from these exposures requires an estimation of ambient air concentrations in the facilities where the polymeric materials are stored. Volatile organic compound concentrations may be determined by conducting either personal or area monitoring. Measured data, however, are often absent or difficult to secure. Our aim is to evaluate the feasibility of utilizing the publically available SLAB Program within the U.S. Environmental Protection Agency's Simulation Tool Kit for Indoor Air Quality and Inhalation Exposure (IAQX SLAB Program) to rapidly predict screening level VOC air concentrations for polymeric products in storage facilities. The IAQX SLAB Program employs an emission model developed to estimate VOC emissions from diffusion-controlled homogeneous slabs, originally from "slabs" of new carpet backing. We predict air concentrations using the IAQX SLAB Program configured with different input parameters to include different: polymeric materials, VOCs, polymeric material forms (i.e., bagged pellets and rolls of polymer film), solid to air partition coefficients, polymeric material thicknesses, storage facility volumes, and storage facility air exchange flow rates. We then compare these modeled estimates to monitoring data or air concentrations predicted using head-space testing data. Results indicate that the IAQX SLAB Program may have potential utility in providing rapid air concentration estimates. If researched further, this application may contribute to protecting the health of both workers and consumers exposed to VOCs diffusing from stored polymeric materials.

Abstract Number	**P-1-04-23**
Presenter	Regina E. Ducret-Stich*, Elisabetta Corradi, Maria Foraster, Xavier Morelli, Inmaculada Aguilera, Xavier Basagaña, Marcela Rivera, Rémy Slama, Nino Kuenzli, Harish C. Phuleria
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

SPATIAL DISTRIBUTION AND MODELING OF ULTRAFINE PARTICLE NUMBER CONCENTRATION IN A SWISS URBAN CITY

Background and Aims: This study is part of "Projet Tri-national Trafic, Air, Bruit et Santé" (TRITABS), a tri-national study on traffic air pollution, noise and cardiovascular health in three European cities: Basel (CH), Girona (ES) and Grenoble (FR). As spatial distribution of road traffic noise and air pollution varies between cities, city-specific analyses are required to disentangle their effects on cardiovascular health. This paper focuses on the spatial distribution and modeling of particle number concentration (PN) in Basel. Methods: 20-minutes measurements of PN and traffic volume were collected at 60 locations across the city of Basel during non-rush hour (9:30-16:00h) and repeated in three seasons: spring, summer and winter. PN was collected using a portable particle counter, miniDiSC (miniature diffusion size classifier), which measures ultrafine particles in 10-300 nm range. For each monitoring location detailed spatial characteristics were recorded and potential predictor variables were derived using geographic information systems (GIS). The spatial characteristics and GIS derived variables were used to build multivariate linear regression models for predicting PN concentrations in Basel. Results: Traffic-related mean PN levels at street, city center and urban background sites were 18975 ± 12449 particles/cm3, 17516 ± 9144 particles/cm3 and 10495 ± 8219 particles/cm3, respectively, with the highest levels in winter and the lowest in summer. Main predictors of the model were background PN levels, type of the site, log of the distance to the nearest main road, season and land-use category fields. The model explained 42% of the total PN variation. Conclusions: Our first model using GIS-derived traffic and land-use variables was able to moderately predict PN levels in Basel. The model will be further refined and the representativeness of these short-term predictions for longer-term PN exposures will be additionally examined.

Abstract Number	**P-1-04-24**
Presenter	Craig Dalton*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Strategic Air Quality Monitoring Near Open Cut Coal Mines, Hunter Valley, Australia

Background: The Hunter Valley, NSW, Australia, has one of the highest concentrations of open cut coal mines adjacent to significant population centres and feeds Newcastle, the largest coal exporting port in the world, with over 120 million tonnes of coal per year. Significant land use conflict and environmental health concerns, including coal dust particulate matter, have grown with the expansion of the industry. The NSW Government, in partnership with coal and power industries established an ambient-air monitoring network in 14 strategic locations 2010 and 2012. Network objectives are to: 1) provide credible, reliable and real-time information (within one hour) on dust concentrations online ; 2) present real-time information using an interactive mapping system; 3) provide SMS and email updates and alerts; and 4) provide long-term information about dust concentrations to inform mine planning and management. Methods: Fourteen TEOM PM10 monitors were placed in areas adjacent to mines, in population centres and in “pristine” locations to record background PM10 levels. Two of the three PM2.5 monitors were placed in the major population centres adjacent to mines with populations of 23,000 and 17,000 and in one small village with significant air quality impacts. Speciation of particulate matter is currently underway. Results: Annual average PM10 and PM2.5 levels have ranged from 20 to 25 µg/m3 for PM10 and 8 to 10 µg/m3 for PM2.5 in the main towns and the smaller village. Multiple exceedances of the 50 µg/m3 24 hour average PM10 standard occur. In 2012, the highest 24 hour average PM10 level was 63.6 µg/m3 in a major population centre. The peak 24 hour average PM2.5 was 26.4 µg/m3. Conclusion: The network has provided a better understanding of air quality impacts and sources of particulates in the Hunter Valley. Challenges regarding technical analysis and community perceptions of the data will be presented. Particle speciation findings will also be presented.

Abstract Number	**P-1-04-25**
Presenter	Ekaterina Konstantinova*, Anatoly Varaksin, Irina Zhovner, Tatiana Maslakova, Konstantin Antropov
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

TRENDS IN RISK FACTORS AND HEALTH STATUS OF EKATERINBURG PRESCHOOL CHILDREN IN 2001-2011: FINDING SETS OF RISK FACTORS THAT HAVE MOST NEGATIVE HEALTH EFFECT

Background: Temporal trends in risk factors (RF) are well-defined and multidirectional whereas their health impact is not always obvious. This study aims to analyze the trends in the health status and RF, development of methods to identify the set of RF having most negative health effect and formulation of management decisions. Methods: We conducted study of most prevalent kinds of diseases in preschool age children and RF in 2001-2011 in Ekaterinburg (Russia). Analyzed RF included indoor air pollution (gas stoves usage, tobacco smoke) environmental pollution (outdoor air and the drink water quality); socioeconomic factors (mother education level, child's physical activity level). 2215 preschool age children were examined. The Classification tree method and the logistic regression analysis were applied for examine a link between RF and children health (CH). NO2 concentration in outdoor air was estimated from Land Use Regression models. Results: 10-year long study found such trends as increasing the number of cars in 2,1 times, some improving the quality of drink water. The prevalence of cardiovascular and musculoskeletal system diseases has noticeably increased. Methods to determine combinations of RF negatively affecting health and to find the social factors that can offset the negative impact of environmental pollution on CH were elaborated.Examples: combination of high level of outdoor air pollution with gas stove in the flat and physical inactivity in children lead to increase the prevalence of respiratory diseases by 2,4 times. The combination of a physical activity in children with higher maternal education and nonsmoking mother can offset the negative health effects of indoor air pollution from gas combustion. The prevalence of cardiovascular diseases could be reduced in 2,1 times. Conclusions: During study period we have observed multidirectional and well-defined trends in RF and in the diseases prevalence. Detected sets of RF can be used by public health practitioners to allocate of limited resources for CH improvement.

Abstract Number	**P-1-04-26**
Presenter	Alena Bartonova*, Hai-Ying Liu, Mukesh Sharma, Kamlesh Katiyar, Onkar Dikshit, Martin Schindler, Sailesh Behera
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Using emission estimates as exposure matrix: Respiratory Disease in Relation to Outdoor Air Pollution in Kanpur, UP, India

Background: Air quality in Kanpur, Uttar Pradesh, India, was poor during the first half of 2000's, often showing daily PM levels in the range of hundreds of micrograms/m3. Air quality monitoring did not cover the whole city and all times, and information about potential health effects was missing. No health impact assessment was previously done. Yet it was clear that evidence for health effects of poor air quality needs to be gathered. Aim: We wanted to evaluate the effect of outdoor air pollution on respiratory disease in Kanpur. Methods: Available data were journal information on respiratory symptoms and hospital visits of patients of a local specialized hospital in 2006, and sporadic air quality monitoring results not covering the whole region. Emission inventory for SO2, NOx and PM10 was developed on a 1x1 km grid, and health information and exposure based on home address emission category were analyzed using logistic regression models. Results: The main sources of air pollution are industries (SO2 and NOx), domestic fuel burning (SO2, PM, NOx) and vehicles (NOx and PM). The emissions of PM per grid are strongly correlated to the emissions of SO2 and NOX. There is a strong correlation between visits to the hospital due to respiratory disease and emission strength in the area of residence. Conclusion: The results clearly indicate that appropriate health and environmental monitoring, actions to reduce emissions to air, and further studies that would allow assessing the development in health status are necessary. We have also shown that other exposure metric than air concentration can be used in the absence of air quality data, to demonstrate the clear effect of pollution on health.

Abstract Number	**P-1-04-27**
Presenter	Chih-Da (John) Wu, Piers MacNaughton, Steven Melley, Kevin Lane, Gary Adamkiewicz, John L Durant, Doug Brugge*, John D. Spengler
Exposure	ambient air pollution
Health domains	equity
Type of research	exposure modeling

Vertical Distributions of Particulate Air Pollution and Potentially Exposed Populations near urban Highways: Implications for Exposure Assessment

Background: Due to data collection challenges, the vertical variation in population and particulate air pollution are typically not accounted for in exposure assessments, which may lead to misclassification of exposures based on height of residency. Aims: The objective of this work was to assess the vertical distribution of exposed populations and their relative potential exposures to air pollutants. Methods: The vertical distribution of the potentially highly exposed population (PHEP), defined as all residents within the 100-m buffer zone of the above-ground highways or the 200-m buffer zone of a tunnel exit, was estimated by four floor categories in Boston's Chinatown (MA, USA) using a three-dimensional digital geography (3DIG) methodology. Vertical profiles of particle number concentration (7-1000 nm; PNC) and PM2.5 mass concentration were measured by hoisting instruments up the vertical face of an 11-story (35-m) building near the study area on multiple days. The concentrations from all the profiles (n=23) were averaged together for each floor category. PHEP was multiplied by the average PNC at each floor category to assess the exposures for near-highway populations. Results: As measurement height increased from 0 to 35 m PNC decreased by 7.7%, compared to 3.6% for PM2.5. PHEP was multiplied by the average PNC at each floor category to assess the exposures for near-highway populations. This result of PHEP multiplied by PNC (residents × particles/cm3) suggested that adding vertical air pollution data could help to better define exposures for near-highway populations during certain meteorological conditions. Conclusion The results show that adding temporally-averaged vertical air pollution data had only a small effect on residential ambient exposures for our study population. Greater differences were observed when winds were from the northeast (off the highways).

Abstract Number	**P-1-04-28**
Presenter	Xiao Sun*
Exposure	organic compounds
Health domains	no health domain
Type of research	randomized trial

Volatile organic compounds in normal human exhaled breath, a long neglected pollutant source

At present, indoor VOCs pollution was widespread concerned. However, for human emission of VOCs, fundamental data was in shortage in the field of indoor air quality (IAQ). In this study, 11 male subjects without smoking habit, 12 female subjects without smoking habit and 12 male subjects with smoking habit were selected. Their samples of exhaled breath were collected and concentrated by sampling bags and sorbent tubes, and analyzed by gas chromatography-mass spectrometry (GC / MS). 135 VOCs were observed in all 35 samples. An average breath sample contained 79.7 VOCs (SD16.2, range 43–110) were obtained, 12 VOCs were observed in all 35 subjects. Furthermore, quantitive analysis of main indoor pollutants: benzene, toluene, xylene and naphthalene were performed, as well as TVOC. The effect of gender was found not as strong factor as the effect of smoking habit. Exhaled VOCs of female subjects were of higher concentration than male subjects. Exhaled VOCs of subjects with smoking habits were more diverse and of higher concentration. Keywords: Volatile organic compounds; Exhaled breath; Indoor air quality

Abstract Number	**P-1-04-29**
Presenter	Daniel Vallero*, Peter Egeghy, Timothy Buckley, John Wambaugh, Kristin Isaacs, Michael-Rock Goldsmith, Mark Strynar, Halûk Ozkaynak, Jade Mitchell
Exposure	others
Health domains	other
Type of research	exposure modeling

Mapping ExpoCast onto ToxCast

The U.S. Environmental Protection Agency (EPA) established the program known as ToxCast to develop ways to predict potential toxicity of chemicals and to develop a cost-effective approach for prioritizing the thousands of chemicals that require toxicity testing. ToxCast uses advanced science tools to help to understand how normal human body processes are impacted by exposures to chemicals and to help determine which exposures are most likely to lead to adverse health effects. Such toxicity information must be integrated with exposure information to prioritize chemicals awaiting risk assessment. Thus, EPA is integrating its exposure-based chemical prioritization program, ExpoCast, with ToxCast to prioritize chemicals. This presentation will discuss recent approaches, such as statistical and graphical extrapolations from data-rich to data-poor chemicals, chemical analysis of dust and other media as indicators of near-field exposure, application of high tier models (e.g., SHEDS-Lite and SHEDS-Fugacity models) to high throughput screening, dose ranking approaches, and “big data” techniques (including informatics and data mining) combined with product use and activity data (e.g. material safety data sheets, consumer self-reported data and the Consolidated Human Activities Database).

Abstract Number	**P-1-04-30**
Presenter	Stella Hartinger Pena*, Adwoa Commodore, Jan Hattendorf, Claudio Lanata, Ana I Gil, Hector Verastegui, Manuel Aguilar-Villalobos, Daniel Mäusezahl, Luke P Naeher
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Chimney stoves modestly improved indoor air quality measurements compared with traditional open fire stoves: results from a small-scale intervention study in ru

Background: Nearly half of the world's population depends on biomass fuels to meet domestic energy needs, producing high levels of pollutants responsible for substantial morbidity and mortality. Aims: We compare carbon monoxide (CO) and particulate matter (PM2.5) exposures and kitchen concentrations in households with study promoted intervention (OPTIMA-improved) stoves and control stoves in San MarcosProvince, Cajamarca Region, Peru. Methods: The study was embedded in a community-RCT carried out in the northern highland of Peru. We determined 48hr indoor air concentration levels of CO and PM2.5 in 93 kitchen environments and personal exposure, after OPTIMA-improved stoves had been installed for an average of seven months.We used Draeger Pac III datalogger to measure real-time CO and particle-size-selective Triplex Cyclones to measure 48hr time-integrated PM2.5 measurements. Housing characteristics and stoves' functionality were assessed through questionnaires and participatory observations.Results: PM2.5 and CO measurements did not differ significantly between OPTIMA-improved stoves and control stoves. Although not statistically significant, a posthoc stratification of OPTIMA-improved stoves by level of performance revealed mean PM2.5 and CO levels of fully functional OPTIMA-improved stoves were 28% lower (n=20, PM2.5, 136µg/m3 95%CI 54-217) and 45% lower (n=25, CO, 3.2ppm, 95%CI 1.5-4.9) in the kitchen environment compared to the control stoves (n=34, PM2.5, 189µg/m3, 95%CI 116–261; n=44, CO, 5.8ppm, 95%CI 3.3-8-2). Likewise, although not statistically significant, personal exposures for OPTIMA-improved stoves were 43% and 17% lower for PM2.5 (n=23) and CO (n=25) respectively. Conclusions: Stove maintenance and functionality level are factors worthy of consideration for future evaluations of stove interventions.

Abstract Number	**P-1-05-01**
Presenter	Chi-Chi Lin*, Shu-Chen Hsu
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

A Study on capacity of building materials to improve indoor air quality in terms of chemical and physical properties

Volatile organic compounds (VOCs) from building materials (BM) are harmful to human health. Indoor ozone is harmful to human health and can react with VOCs then produce secondary pollutants which may pose greater threats to human health. This study aims to find out ozone removal rates, VOCs emission and corresponding carbonyls generation by ozone reaction with VOCs in different types of BM. The relationship between BM properties and ozone removal rates along with carbonyls generation could be found by the analyses of specific surface area and total pore volume on BM. The result showed that the ozone removal efficiency for calcium silicate board of green building material (GBM), calcium silicate board, mineral fiber ceiling, gypsum board of GBM, gypsum board, mineral fiber ceiling of GBM, wooden flooring and wooden flooring of GBM were 64%, 62%, 58%, 50%, 40%, 37%, 28% and 18%, respectively. The emissions of carbonyls and BTEX were detected on different BM. The concentrations of carbonyls generation from wooden flooring, gypsum board, calcium silicate board, wooden flooring of GBM, calcium silicate board of GBM, gypsum board of GBM, mineral fiber ceiling and mineral fiber ceiling of GBM were 194.8 µg/m3, 145.8 µg/m3, 97.2 µg/m3, 79.7 µg/m3, 65.7 µg/m3, 57.7 µg/m3, 6.1 µg/m3 and 3.6 µg/m3, respectively. There were positive correlations between ozone removal efficiency and carbonyls generations on BM. A positive correlation was found between the surface areas of BM and ozone removal efficiency as well. In this study, the result showed that carbonyls and BTEX were emitted from BM. It is beneficial to remove some part of ozone when ozone passing through BM. However, there are lots of harmful compounds such as carbonyls (e.g., formaldehyde) produced and emitted into indoor space at the same time. Therefore, it is important to investigate the common BM used in terms of the VOC emissions, ozone removal efficiency, and carbonyls generations.

Abstract Number	**P-1-05-02**
Presenter	Luann Brink*, Lynne Marshall, Stacey Benson, Evelyn Talbott
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Adverse Birth Outcomes Associated with Exposure to Ambient Air Pollution in Allegheny County, PA, US

Background: Exposure to air pollution has been linked to adverse birth outcomes. A national assessment of maternal exposure to benzene, as modeled by NATA in 1996 and 1999, found an increase in the odds of a low birth weight (LBW) events. They also found that birth weight of newborns significantly decreased for every 1 µg/m3. Methods: All 2005 births records for Allegheny County, Pennsylvania were obtained from the Pennsylvania Department of Health (n=12,995). Live births less than 500 grams were excluded from analysis. Geospatial coordinates were used to place mother's residence within the appropriate census tract. The outcome LBW was categorized as births <2500 g. The outcome preterm was births <37 weeks gestation, and term LBW was coded as gestational age ≥ 37 weeks with a birth weight <2500 g. The total concentrations of benzene, diesel particulate matter (DPM), and TCE were obtained from NATA 2005 at the census tract level and linked to each mother's residence Results: All models were adjusted for significant covariates that included mother's educational level, age, race, prenatal care, plurality, smoking status, gestational diabetes, gestational hypertension, poverty, and previous poor birth outcomes. The pollutants were significantly associated with each birth outcome prior to adjustment (Table 1). Once adjusted, only DPM was significantly associated with LBW and preterm births (Table 2). For every one unit increase in DPM, the odds of LBW increased by 13%. Benzene showed a similar trend but was borderline significant (p=0.067). For every one unit increase in DPM the odds of preterm birth increased by 16%. Conclusions: Significant associations were observed between the yearly average diesel particulate air pollutant level and birth outcomes (preterm and LBW). A major limitation of this study is that we were not able to account for any change in residence during the pregnancy.

Abstract Number	**P-1-05-03**
Presenter	Rebecca Ghosh*, Marta Blangiardo, Chloe Morris, Danielle Vienneau, John Gulliver, Kayoung Lee, David J. Briggs, Anna Hansell
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Air pollution exposures from the 1970s confound associations between PM10 in 2001 and mortality 2001-2009 in a long-running English cohort

Background: Long-term air pollution exposure contributes to mortality but there are few studies examining effects of very long term (>20 years) exposures. Aim: This study investigates air pollution exposures from 1971 on mortality to 2009 in the ONS Longitudinal Study (LS), a long-running cohort comprising an anonymised 1% representative sample from the census of England and Wales. Methods: Land use regression techniques were used to model annual average exposures to PM10 in 2001 and black smoke (BS) and SO2 in 1971. Logistic regression was used to investigate the association of BS or SO2 exposure in 1971 and PM10 in 2001 with later mortality in 367,658 members of the LS present in 1971, adjusting for age, sex, social class of individual, area-level deprivation, population density, urban land cover and geographical region. Results: PM10 exposure in 2001 was weakly correlated with BS in 1971 (Spearman correlation r=0.20) and moderately with SO2 in 1971 (r=0.41). BS and SO2 in 1971 were highly correlated (r=0.73) The association between all-cause mortality 2002-2009 and PM10 exposure in 2001 was OR 1.28 (1.18-1.38). Exposure to BS and SO2 in 1971 reduced observed associations of mortality 2002-9 with PM10– when BS 1971 was included in the model, the PM10 OR reduced to 1.02 (1.00-1.04) and when SO2 1971 was included in the model the PM10 OR reduced to 1.00 (1.00-1.01). Similar patterns were seen for cardiovascular and respiratory disease mortality. (All ORs expressed per 10µg/m3.) Conclusions: Historic air pollution exposures appear to confound associations of PM10 with mortality in more recent years. Residual effects from unobserved covariates such as smoking cannot be excluded as limited covariate information is available from the Census. Census output is Crown copyright and is reproduced by permission. Permission of the ONS to use the LS is gratefully acknowledged, as is help from staff of CeLSIUS -clearance 30101.The authors alone are responsible for the interpretation of the data

Abstract Number	**P-1-05-04**
Presenter	Payam Dadvand*, Francesc Figueras, Xavier Basagaña, Rob Beelen, David Martínez, Marta Cirach, Anna Schembari, Gerard Hoek, Bert Brunekreef, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Ambient Air Pollution and Preeclampsia: a Spatiotemporal Analysis

BACKGROUND: The available evidence linking air pollution and preeclampsia is very limited with no report on the impact of this exposure on early- and late-onset preeclampsia. AIMS: To investigate the association, if any, between preeclampsia (all, early- and late-onset) and exposure to NO2, NOx, PM10, PM2.5, PM2.5-10 and PM2.5 light absorption during the entire pregnancy, and first, second, and third trimesters. METHODS: This study was based on 8,398 pregnant women (including 103 cases of preeclampsia) residing in Barcelona, Spain (2001-2005).A spatiotemporal exposure assessment framework was applied using land use regression models to predict pollutant levels at the geocoded address of each study participant's residence during each week of her pregnancy. Logistic regression models were used to quantify the un-adjusted and adjusted associations. A sensitivity analysis was conducted by matching cases and controls according to the length of exposure and applying conditional logistic regression to estimate the association. RESULTS: An interquartile-range increase in PM2.5 exposure during the entire pregnancy and third trimester and to PM2.5 absorbance during the third trimester were respectively associated with 32%, 51%, and 39% increase in the risk of preeclampsia. There was a 42% increase in the risk of late-onset preeclampsia associated with an interquartile-range increase in the third trimester PM2.5 exposure. The findings for the third trimester exposure were unlikely to be biased by the different length of exposure between cases and controls. CONCLUSION: Exposure to fine particulate air pollution seems to increase the risk of preeclampsia, particularly late-onset preeclampsia. Our findings were compatible with proposed distinct pathogenesis for early- and late-onset preeclampsia.

Abstract Number	**P-1-05-05**
Presenter	Shaowei Wu, Furong Deng, Hongying Wei, Jing Huang, Hongyi Wang, Masayuki Shima, Xin Wang, Yu Qin, Chanjuan Zheng, Yu Hao, Xinbiao Guo*
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Ambient Particulate Air Pollution and Circulating Biomarkers in Healthy Adults: the Health Volunteer Natural Relocation Study

Background: Ambient air pollution has been associated with activation of systemic inflammation and hypercoagulability and increased plasma homocysteine, but the chemical constituents behind the association are not well understood. Aims: We examined the relations of chemical constituents of fine particles (PM2.5) and biomarkers of inflammation, coagulation and homocysteine in the context of traffic-related air pollution. Methods: A panel of 40 healthy college students underwent biweekly blood collection for 12 times before and after relocating from a suburban campus to an urban campus with changing air pollution contents in Beijing. Blood samples were measured for circulatory biomarkers ofhigh-sensitivity C reactive protein (hs-CRP), tumor necrosis factor alpha (TNF-α), fibrinogen,plasminogen activator inhibitor type 1 (PAI-1), tissue-type plasminogen activator (t-PA), von Willebrand factor (vWF), soluble platelet selectin (sP-selectin), and total homocysteine (tHcy). Various air pollutants were measured in a central air-monitoring station in each campus and 32 PM2.5 chemical constituents were determined in the laboratory. We used mixed-effects models to estimate the effects of PM2.5 chemical constituents on circulatory biomarkers. Results:We found consistent positive associations between the following biomarkers and PM2.5 chemical constituents across different models: TNF-α with secondary organic carbon, chloride, zinc, molybdenum and stannum; fibrinogen with magnesium, iron, titanium, cobalt and cadmium; PAI-1 with titanium, cobalt and manganese; t-PA with cadmium and selenium; vWF with aluminum.We also found consistent inverse associations of vWF with nitrate, chloride and sodium, and sP-selectin with manganese. Conclusions: Our results provide clues for the potential roles that PM2.5 chemical constituents may play in the biological mechanisms through which air pollution may influence the cardiovascular system.

Abstract Number	**P-1-05-07**
Presenter	Arian Saffari, Nancy Daher, Flemming Cassee, Martin Shafer, James Schauer, Constantinos Sioutas*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Association of organic species with seasonal and spatial variability in redox activity of ultrafine particles in the Los Angeles Basin

Recent toxicological studies have linked oxidative potential of ultrafine particles (dp< 0.1-0.2 µm) to adverse health effects, ranging from respiratory problems to cardiovascular diseases and lately to neurological diseases. In order to investigate the redox activity of this important size range and in particular its correlation with inorganic and organic ultrafine PM species, a year-long sampling campaign of quasi-ultrafine particles (dp< 0.25 µm) was conducted at 9 distinctive sites representing source, near-freeway and rural receptor locations across the Los Angeles air basin. Redox activity of the ultrafine PM samples was measured using the Dithiothreitol (DTT) assay and detailed chemical analysis was performed to measure the concentrations of inorganic and organic species. Redox activity per unit volume (m3) of air (an indicator of oxidative potential associated with exposure to PM) showed distinct seasonal and spatial variations, ranging between 0.2 and 1.4 (nmol DTT/min/m3 air). Peaks generally occurred during the fall and comparable values were observed during winter and summer. Noticeable peaks were also observed at near-freeway locations representing the source sites for vehicular and industrial emissions. Regression analysis indicated strong correlation of DTT with organic carbon (OC) across all seasons and strong winter-time correlations with tracers of primary vehicular emissions including polycyclic aromatic hydrocarbons (PAHs), alkanes, hopanes and steranes. During the summer, correlations with semi-volatile compounds, such as PAHs were significantly weaker. Water soluble organic carbon (WSOC) and also tracers of biogenic secondary organic aerosol (SOA), however, displayed higher correlations with DTT during the summer time compared to winter suggesting that the contribution of organic species from both primary and secondary sources is important to the overall oxidative potential of ultrafine PM.

Abstract Number	**P-1-05-08**
Presenter	Jicheng Gong*, Junfeng Zhang, Tong Zhu, Howard Kipen, Guangfa Wang, Min Hu, Pamela Ohman-Strickland, shou-En Lu, David Q Rich, Wei Huang, Wanting Lin
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cohort study

Associations of Ultrafine Particles and Biomarkers of Inflammation, Oxidative Stress, Thrombosis, and Autonomic Dysfunction in Healthy Young Adults

Background: There have been increasing concerns on the health effects of ambient ultrafine particles (UFP), but results from a few epidemiological studies have been inconsistent. Aim: We conducted a panel study to examine whether and how UFP concentrations, in comparison to PM2.5 mass concentrations, were associated with various biomarkers of different physiological pathways. Method: We measured number concentrations of UFP and biomarkers of pulmonary/systemic inflammation and oxidative stress, heart rate and heart rate variability, and biomarkers of thrombosis in 125 young and healthy adults before, during and after the air control measures implemented for the Beijing Olympics. Linear mixed models were used to analyze the associations of biomarkers with UFP concentrations measured 1 to 7 days prior to biomarker measurements (lags). Results: UFP number concentrations were significantly associated with each of the biomarkers of thrombosis, pulmonary/systemic inflammation and oxidative stress, at multiple lags. For the endpoints of autonomic tone, only systolic blood pressure, heart rate and the ratio of low frequency to the high frequency of power (heart rate variability) showed significant associations with UFP. UFP showed larger and quicker associations with the biomarkers of thrombosis and those of pulmonary inflammation and oxidative stress than with the biomarkers of systemic inflammation and whole-body oxidative stress. For some biomarkers, differences in association patterns (e.g., lag days with the most significant associations) were observed for UFP number concentrations compared for PM2.5 mass concentrations. Conclusions: Because UFPs may interact with biological systems differently than larger particles, the associations between UFP concentrations and the biomarkers of various pathophysiologic pathways observed in this study provide additional insights on underlying mechanisms of PM health effects.

Abstract Number	**P-1-05-09**
Presenter	Joshua Apte*, Andrew Goodkind, Jay Coggins, Julian D. Marshall
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Blue Skies Bluer? Puzzling implications of a possible supra-linear relationship between PM exposure and mortality

Background and Aims: Recent studies raise the possibility that some health endpoints follow supra-linear concentration-response functions (CRFs). Here, we examine implications of supra-linearity for the design of economically efficient policies to reduce health effects associated with PM2.5 exposures. Methods: We compare two classes of recently published CRFs for cardiopulmonary mortality associated with PM-2.5: (1) a conventional log-linear model, and (2) a supra-linear log-log model. Each CRF is used to model the concentration dependence of the marginal health benefit associated with a fixed 1 µg m-3 reduction in ambient PM-2.5. Results: For a log-linear CRF, the marginal health benefit of a 1 µg m-3 reduction in ambient concentrations has weak dependence on the initial level. In contrast, for the supra-linear (log-log) CRF, the marginal health benefit of a 1 µg m-3 improvement is greatest at low concentrations and drops sharply for more polluted conditions. Surprisingly, for a supra-linear CRF, an efficiency-oriented solution might prioritize marginal pollutant improvements in locales with low annual-average concentrations. This unexpected feature of supra-linear CRFs goes against a key assumption in environmental economics that the marginal benefit of pollution control declines with increasing abatement. Conclusions: Several new challenges would arise for science and policy if supra-linear CRFs were demonstrated to exist for PM2.5. To achieve a given level of population health, more stringent controls on ambient PM2.5- levels may be required than previously assumed. Furthermore, individual policies cannot be understood in isolation; reducing emissions at two sources may have a greater benefit than the addition of the benefits of cleaning either source individually. An economically “optimal” pollution abatement strategy might de-emphasize control in the most polluted communities, raising important concerns for environmental justice.

Abstract Number	**P-1-05-10**
Presenter	Mar Álvarez Pedrerol*, Joan Forns, Jesús Pujol, Xavier Querol, Jordi Sunyer
Exposure	ambient air pollution
Health domains	neurobehavioral effects
Type of research	cohort study

BREATHE Project (Brain Development and Air Pollution ultrafine particles in school children): Research protocol and first results.

Background: The influence of air pollution on the brain development is unknown. Accumulating evidence suggests that air pollution may have a significant impact on inflammation of the central nervous system and consequently on behaviour and school performance. The BREATHE project evaluates whether traffic-related air pollutants (TRAPs) may impair brain development of school children in the city of Barcelona. BREATHE combines epidemiological, psychometric, genetic, neuroimaging and mathematical approaches. Objectives: The aim of the present work is to describe the project. Methods: The study was conducted during the period from January 2012 to February 2013. The components in the BREATHE project are: 1) TRAPs were measured in 39 schools during two campaigns of one week periods, including black carbon, ultrafine particles counts, PM1, PM2.5, PM10, NO2 levels and mass and patterns of chemical elements in PM0.2, PM0.2-2.5 and PM2.5-10. Noise was also measured. 2) Computer tests for working memory (n-back test) and attention were conducted four times in 2,745 children aged 7 to 9 years in the 39 schools. ADHD symptomatology and school achievement of children were reported by teachers and parents filled in the Strengths and Difficulties Questionnaire (SDQ). 3) DNA was extracted from oral cells to study gene-environment interactions. 4) Neuroimaging in a subset of the children was conducted to study structural alterations. Results: 54 % of the invited children accepted to participate. Participating children did not differ in terms of age and sex, but had a higher good school achievement and a lower prevalence of ADHD tan non-participating. The frequency of ADHD was high as well as the average of the SDQ and the frequency of the poor school performance. The overall median of the outcomes (n-back test) among all the children was very similar to the median per school. Conclusions: Overall, we present the largest study on the cognitive and structural effects of school air pollution.

Abstract Number	**P-1-05-11**
Presenter	Motoyuki Nakao*, Fumiko Ono, Hisamitsu Omori, Bandi Solongo, Yoko Ishihara
Exposure	others
Health domains	respiratory disease
Type of research	cross-sectional study

Chronic Obstructive Pulmonary Disease in Ulaanbaatar: the Japan and Mongolia international study

[Background]: The rapid economic growth in Mongolia is worsening its air pollution problem. In addition to the common use of smoky fuel such as coal in the small traditional houses (Ger), smoking rate is considered to be high. Despite these conditions, few prevalence studies of COPD have been performed in Mongolia. [Aims]: International study of Japan and Mongolia using spirometer was conducted to measure the prevalence of air flow limitation among Mongolian adults. [Methods]: Clinical, spirometric data, and the data of exposure to risk factor were collected from 381 subjects aged >40 years from the populations living in Ger district and urban area of Ulaanbaatar. Airflow limitation was defined according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. [Results]: Severity of airway obstruction according to GOLD criteria was: 44.7% mild; 50.0% moderate; 5.3% severe; and no very severe when subjects with COPD combined with restrictive lung disease were excluded. Smoking rate of participants was 27.0% current smoker and 5.8% former smoker. The 66.4% of male and 16.4% of female were ever smoker. Prevalence of COPD among ever smoker was 5.5% (13.6% of male; 1.6% of female). Meanwhile, prevalence of COPD among never smoker was 4.5%. Furthermore, prevalence of COPD among ever smoker excluding possible asthmatic patient was 3.1% (8.0% of male; 0.8% of female). On the other hand, prevalence of COPD among never smoker excluding possible asthmatic patient was 1.8%. In contrast to COPD, prevalence of restrictive lung disease was almost the same in both genders. [Conclusions]: Prevalence of airflow limitation in Mongolia was relatively low when compared with those in other Asian countries. The prevalence of COPD was higher among ever smoked male subjects. The ratio of male to female was approximately 1:10 among ever smoker. These results suggest that the prevalence of COPD was largely attributable to smoking rate in Mongolian adults.

Abstract Number	**P-1-05-12**
Presenter	Tuija Mannisto, Pauline Mendola*, Rajeshwari Sundaram, Kira Leishear, Danping Liu, Seth Sherman, Qi Ying, Enrique Schisterman, S. Katherine Laughon
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Does air pollution impact cardiovascular events during labor and delivery?

Background: Acute air pollution exposure is associated with increased risk of cardiovascular disease (CVD) events in the general population, but the risk in pregnant women is unknown. Aims: To study the effect of air pollution in the week prior to delivery on risk of CVD events during labor/delivery. Methods: We studied a cohort of 223,502 singleton deliveries in the Consortium on Safe Labor (2002-08) with air pollution exposure obtained from Community Multiscale Air Quality models. CVD events were obtained from hospital records. Odds ratios (ORs) of CVD events for one-unit increase in pollutant daily average at days 0 to 7 preceding delivery were estimated by logistic regression with robust standard errors, adjusting for site, age, race/ethnicity, insurance, smoking and pre-pregnancy body-mass index. Total particulate matter (PM) <2.5mg mass was adjusted for in species-specific analyses. A secondary analysis using a case-crossover design was conducted to control for unobserved confounding among first observed CVD events in the cohort. Results: There were 687 (0.3%) pregnancies with CVD events among 681 women. In regression models, increased odds of CVD events were seen after exposure to PM <10mg (OR=1.01 [95% confidence interval:1.00-1.03]), carbon monoxide (CO, OR=1.00 [1.00-1.00]), nitrogen oxides (NOx, OR=1.02 [1.01-1.04]) and sulfur dioxide (SO2, OR=1.05 [1.02-1.09]) with a 5 day lag and after exposure to nitric particles (OR=1.08 [1.00-1.16]) with a 6 day lag. The associations were similar but not significant in the case-crossover analysis (n=681). Ammonium particles increased risk (OR=1.91 [1.03-3.53]) with a 1 day lag in the case-crossover analysis but was nonsignificant in the full cohort (OR=1.36 [0.98-1.88]). Conclusions: Acute exposure to particulate air pollution, CO, NOx and SO2 5 days prior to delivery were associated with a small but statistically significant increase in the risk of CVD events during labor/delivery.

Abstract Number	**P-1-05-13**
Presenter	Yutong Cai*, Tamara Schikowski, Anne-Elie Carsin, Andrea Vierkötter, Margaux Sanchez, Francine Kauffmann, Nicole Probst-Hensch, Ursula Krämer, Nino Kuenzli, Anna Hansell
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Effect of air pollution on prevalence of chronic bronchitis symptoms-a cross-sectional analysis of 5 cohort studies

Background and Aims: Chronic bronchitis symptoms are associated with increased risk of COPD and, in some studies, overall as well as COPD mortality. This study aims to assess effects of outdoor air pollution exposures on chronic bronchitis prevalence in five cohort studies participating in the European Study of Cohorts for Air Pollution Effects (ESCAPE) project. Methods: Annual average air pollution exposures of particulate matter (PM) metrics PM2.5, PM10, PMcoarse, PM2.5absorbance, NO2, NOx derived from Land Use Regression models for 2008-2011 and road traffic measures, were assigned to home address of five European cohorts (E3N, ECRHS,NSHD,SALIA,SAPALDIA) at follow-up periods in 2000-2011. Chronic bronchitis was defined as questionnaire-reported chronic cough and phlegm production for ³3 months for 2 or more years. Cross-sectional multivariable logistic regression analyses were conducted in each cohort, adjusting for a confounder set common to all studies (age, sex, smoking status, interview season, education) followed by random-effect meta-analysis. Results: 13,758 and 8,784 participants respectively were included in NO2 and PM analyses at follow-up. Prevalence of chronic bronchitis ranged from 1.5% in E3N (non-asthmatic females) to 6.8% in SALIA (elderly females). No consistent associations were observed between any air pollution measure and prevalence of chronic bronchitis. Meta-analysis combined ORs were: for NO2 OR: 0.96 (95%CI: 0.89-1.04) per 10ug/m3; for PM10 OR 0.85 (95%CI: 0.53-1.39) per 10ug/m3. Results were suggestive of possible effects in asthmatics and never-smokers in some cohorts but this was not consistent across all studies. Conclusions:In contrast to some previously published European studies, this study did not find consistent effects of current air pollution exposures level on chronic bronchitis symptoms. Further investigations including use of back-extrapolated air pollution values to actual year of questionnaire are needed.

Abstract Number	**P-1-05-14**
Presenter	Satoko Iwasawa*, Takeshi Kochi, Tazuru Tsuboi, Makiko Nakano, Takamoto Uemura, Shigeru Tanaka, Kazuyuki Omae
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Effects of sulfur dioxide on respiratory symptoms in child residents of Miyakejima seven years after returning to the island

Background: Mt. Oyama on Miyakejima Island, Tokyo, erupted in June, 2000. All Miyake village citizens were forced to evacuate from the island in September, 2000, due to continuous eruptions and emissions of unsafe amounts of volcanic gas, mainly sulfur dioxide (SO2). Beginning in February, 2005, citizens began to return to live on the island despite the fact that volcanic gas was still being emitted. Aims: In this study, the health effects of exposure to the environment on Miyakejima Island following the lifting of the evacuation order in February, 2005, were investigated first in February, 2006, and then in each November from 2006 to 2011. The relationship between the amount of exposure to SO2 and health effects was studied in child residents of Miyakejima.Methods: The subjects of this study were registered residents of Miyakejima aged 17 or under at the time of each medical check-up. A total of 1,005 check-ups were conducted. The mean values and the percentage of hourly values that were 0.10 ppm or more were obtained from 81 months of exposure concentration data obtained from fixed-point monitoring. Health effects were evaluated through the self-administered ATS-DLS questionnaire. Results: A significantly higher proportion of persons with an increased frequency of “throat” symptoms was observed in areas with an annual mean SO2 concentration of 20.7 ppb or above when compared with residents in areas with a minimal exposure concentration. In addition, there was a significant increase in “cough”, “eye” and “skin” symptoms in areas where the annual mean SO2 concentration exceeded 28.0 ppb. Conclusions: We observed minor health effects on the respiratory system due to 7-year exposure to SO2 on Miyakejima Island. Follow-up observation should be continued with a focus on the relationship between the amount of exposure to SO2 and health effects until the volcanic gas emissions have ceased.

Abstract Number	**P-1-05-15**
Presenter	Thomas Cole-Hunter*, Mark J Nieuwenhuijsen, Elena Turco, Alberto Fernandez, Mark Williams, Alena Bartonova
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Empowering citizens to improve quality of life in urban environments; the CITI-SENSE Barcelona case study

Background: CITI-SENSE is a four year Collaborative Project partly funded by the EU FP7-ENV-2012 under grant agreement 308524, which commenced in October 2012. Nine different cities (Barcelona, Belgrade, Edinburgh, Haifa, Ljubljana, Oslo, Ostrava, Vienna and Vitoria) will gather sensor-enabled health-relevant information on outdoor urban spaces and indoor school environments. Aims: The overall aim of CITISENSE is to create citizen observatories, and to empower citizens with the means to communicate directly with authorities and policy-makers regarding contemporary urban environmental health issues. In Barcelona, we will focus on urban air pollution. Methods: Mobile and static sensor nodes will be strategically deployed around the city of Barcelona. Dynamic land-use regression modeling will be performed to create a near-real-time map layer of urban environmental health indicators, including CO2, NO2, NOX, PM, and noise. Citizens will be engaged to identify and evaluate contemporary environmental health issues. Results: 20 personal/mobile sensors and 40 geographical/static sensors will be deployed in Barcelona city. The mobile sensors will be carried by interest user-groups such as bicyclists and asthmatics. The static sensors will facilitate land-use-regression modeling, occurring hourly and complementing existing air monitoring network information, to produce advice for citizens via mobile software apps. The city council, environmentalists, bicycle advocates and hospital outpatient groups will assist the development of the final products. Conclusions: The CITI-SENSE Barcelona case study will develop citizen observatories to improve the quality of life in urban environments, facilitating the detection of air pollution and noise level limit breaches that may negatively impact citizens' health and quality of life on a daily basis.

Abstract Number	**P-1-05-16**
Presenter	Roby Greenwald*, Priya Kewada, Fuyuen Yip, Jeremy Sarnat
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Exposure during short-lived air pollution events is more predictive of airway oxidative stress than mean concentration

Background: Exposure to roadway air pollution disproportionately occurs during discrete events. Aims: The relationship between exposure events and health outcomes related to airway oxidative stress and heart rate variability (HRV) were investigated as part of the Atlanta Commuters Exposure (ACE) study. Methods: The frequency and magnitude of exposure events were parameterized in terms of the number of events per 2-hour commute, cumulative event exposure, cumulative event time, pollutant concentration during an event, and the ratio of these quantities to the total exposure. The event analysis procedure was performed for fine particle mass (PM2.5), particle number concentration (PNC), black carbon (BC) and particle-bound PAHs. Measured health outcomes included several HRV parameters and two biomarkers of airway oxidative stress: exhaled nitric oxide (eNO) and malondialdehyde (MDA) measured in exhaled breath condensate. Mixed models were used to assess the impact of event exposure on outcomes using event parameters as predictors. Results: Very few events were observed for PM2.5. For PNC, although 4-5 events per commute were observed, no event parameters were significant predictors for any of the outcomes. For BC and PAHs however, many event parameters were predictors of eNO and MDA, but not for HRV parameters. The strongest predictors were cumulative PAH exposure during an event and PAH concentration during an event. The strength of association was highest for MDA measured immediately following a commute and eNO measured 1 hour following the commute. Mean concentration during a commute had little to no predictive value for most parameters and outcomes. Conclusions: The exposure that occurs during short-lived events of particularly high concentration is more predictive of health outcomes than mean exposure. Since most of these events are related to the presence of particularly dirty vehicles, health improvements might be achieved by removing them or reducing their emissions.

Abstract Number	**P-1-05-17**
Presenter	Eisaku Toda, Shoji Nakayama*, Kiwako Yamamoto, Toshihiro Kawamoto
Exposure	others
Health domains	other
Type of research	cohort study

FIRST INTERIM REVIEW OF JAPAN ENVIRONMENT AND CHILDREN'S STUDY

Background: Japan Environment and Children's Study (JECS) is a birth cohort study which follows up 100,000 new-borns recruited between January 2011 and March 2014 for 13 years to examine the association between pre-natal and childhood exposure to environmental pollutants and health outcomes. As a large-scale national research project, the study undergoes periodical external reviews. Aims: The aim of the review was to ensure the effective and efficient conduct of the study, to evaluate the prospected achievement of its objectives, and to feed back the outcomes to the society. Methods: A planning and evaluation committee composed of external experts developed the first interim review report in February 2013, after site visits to 15 regional centers and hearings from key researchers. Results: 57,754 pregnant women have been enrolled by the end of January 2013, and the trend shows that 93,000-94,000 women will be enrolled by March 2014. Since the study area in Fukushima region was extended to the whole prefecture in October 2012 and minor area extension is envisaged in other regions, the recruitment target of 100,000 is expected to be achieved. The coverage ratio defined as the number of enrolled babies divided by the number of births in the region is estimated at 45%. The coverage ratio in 15 regions ranged between 33% and 67%. Biannual questionnaires were collected from more than 90% of the participants, and the ratio of collection of maternal blood and cord blood was about 80%. Conclusions: The recruitment targets of individual regions were revised according to the achievement so far. Further reviews are expected in FY 2014, 2018, 2023, 2028 and 2033.

Abstract Number	**P-1-05-18**
Presenter	Lauren Petrick*, Mira Rosenblat, Michael Aviram
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	others

Increased macrophage atherogenicity following exposure to ultrafine particles

Background: Exposure to air pollution results in adverse health effects including accelerated atherosclerosis development, the major cause of morbidity and mortality in the western world. Macrophage foam cell formation is the hallmark of early atherosclerosis. Previous studies show that exposure to ultrafine particles (UFP, <0.1 um) in the ambient air results in pro-inflammatory effects and oxidative stress in in-vitro and in animal models. Furthermore, exposure of apoE deficient (-/-) mice to UFP increased the area of their atherosclerotic lesions. However, the atherogenic effects and mechanisms of UFP atherogenicity are not yet clear. Aims: To study the effects of UFP (12 nm SiO2) on macrophages atherogenic functions including: cellular oxidative stress, cholesterol and triglyceride metabolism. Methods: J774.A1 macrophage cell line was used in the study. The cells were seeded in the culture plates at 37°C for 24h, in medium DMED+5%FCS. The medium was then aspirated and replaced with medium containing UFP (0, 5, 10, and 20 µg/mL), and incubated for an additional 24 h. The UFP exposed cells were used for the various in-vitro assays. Results: UFP showed proatherogenic effects on macrophages. With increasing UFP concentrations from 0-20 mg/mL, HDL-mediated macrophage cholesterol efflux decreased by up to 38%, macrophage triglyceride mass increased by up to 77%, macrophage oxidative stress increased by up to 143%, and cellular paraoxonase 2 (PON2) lactonase activity increased by up to 39%, all of which were dose-dependent. Postulated mechanisms are currently being explored and will be discussed. Conclusions: The results obtained indicate that UFP possess pro-atherogenic potential as evident by increased macrophage lipids and oxidative stress. These atherogenic parameters couldbe significant contributors to the observed adverse cardiovascular effects associated with air pollution.

Abstract Number	**P-1-05-19**
Presenter	Tzu-Hsuen Yuan*, Ruei-Hao Shie, Yu-Yen Chin, Chang-Chung Chan
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Increased urinary 1-hydroxypyrene levels among adults living near a petrochemical complex

Background: The suitability of urinary 1-hydroxypyrene (1-OHP), a biological marker, to assess adults' polycyclic aromatic hydrocarbons (PAHs)exposure surrounding a petrochemical complex has not been studied before. Aims: This study aims to investigate whether concentrations of urinary 1-OHP and PAHs in air are related to distances from the emission sources. Methods: We collected spot urine samples from1325 residents aged above 35 and 152 PM2.5 filters within 30 km radius from a petrochemical complex in central Taiwan. The study area was further divided into smaller areas of Zone A for <10km, Zone B for 10-20 km, and Zone C for 20-30 km. Urinary 1-OHP was analyzed by high performance liquid chromatography, while PAHs was done by GC-MS. Multiple linear regression models were used to estimate the distance-to-emission relationship for urinary 1-OHP levels adjusting for potential confounding factors. ANOVA tests were used to compare difference in particulate-phase PAH levels during downwind periods among three zones. Results: ANOVA tests show that urinary 1-OHP level in µmol/mol-creatinine in Zone A (0.17 ± 0.29) was higher than that in either Zone B (0.14 ± 0.30) or Zone C (0.11 ± 0.31). Multiple linear regression models showed that residents who were in Zones A and B had higher urinary 1-OHP levels than those lived in Zone C. Those who were females or smokers also had higher 1-OHP levels regardless where they lived. The concentrations of industry-related PAHs, such as 4-ringed B(a)A, B(k)F, Fl and Pyr, in Zone A were higher than those in Zone B and C during downwind periods. Their respective concentrations in ng/m3 were 0.025 ± 0.047 for B(a)A, 0.024 ± 0.050 for B(k)F, 0.036 ± 0.086 for Fl, and 0.026 ± 0.045 for Pyr in Zone A. Conclusion: 1-OHP levels of adult's urine samples can be used to assess resident's exposure to PAHs emitted from petrochemical manufacturing process.

Abstract Number	**P-1-05-20**
Presenter	Sadegh Niazi Esfyani, Morteza Seifi, Samira Nabavi, Masud Yunesian, Hassan Amini*
Exposure	ambient air pollution
Health domains	cancer
Type of research	cross-sectional study

Long-term air pollution exposure and breast cancer

Background: Women in urban communities of Iran have the highest incidence rates of breast cancer (BC). The reasons behind this are not fully understood and many of the causes remain unexplained. Aims: The aim of this study was to examine the relationship between exposure of BC cases and exposure of the general population to long-term air pollutants in the Middle Eastern City of Tehran, Iran. Methods: Records of 1534 BC patients were obtained from Non Communicable Disease Center belong to Ministry of Health (with disease onset during 2008 to 2009). Thereafter, they were successfully geo-coded within Tehran megacity by Geographic Information System (GIS) Bureau of Iran's Post Office based on their postal code. On the other hand, 3008 random cases were created within the city by a GIS. The individual long-term exposure to sulfur dioxide (SO2) and particulate matter ≤ 10 µm (PM10) air pollutants of all BC and random cases were estimated using land use regression models. Finally, bivariate correlations of the exposure of these groups were calculated. Results: The annual mean concentration of SO2 and PM10 in the BC cases were 62.9 parts per billion (ppb), and 97.6 µg/m3, respectively. While in our random points the mean exposures for mentioned pollutants were 54.1 ppb, and 93 µg/m3, respectively. The correlation of long-term exposure to SO2 between BC and random cases was positive and significant (r = 0.06, p = 0.019). Meanwhile, the correlation of long-term exposure to PM10 between BC and random cases was positive and significant (r = 0.05, p = 0.037). Conclusions: We have found that long-term air pollution exposure is associated with breast cancer.

Abstract Number	**P-1-05-21**
Presenter	Stockfelt Leo*, Peter Molnar, Annika Rosengren, Lars Wilhelmsen, Gerd Sallsten, Lars Barregård
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term effects on cardiovascular and non-accidental mortality by exposure to NOx in the primary prevention study cohort – preliminary findings

Background and aims: Exposure to air pollution increases cardiopulmonary mortality. Based on the American Cancer Society study an estimated 5000 premature deaths per year in Sweden are caused by long-term exposure to fine particles. The composition of air pollution, as well as other factors, varies over the world though. To provide a risk assessment for Sweden we studied the long term health effects of air pollution in a well-characterized cohort. Methods: Out of a random sample of 10,000 Gothenburg men aged 47- 55 years at baseline, 7495 men were examined in 1970-73 including questionnaires, physical examination and blood samples, to determine predictors of cardiovascular disease. NOx-levels for 1975 were modeled and individual exposures at residential addresses for those living in Gothenburg set (≈90% success rate). Using Cox regression we calculated the risk of non-accidental death and cardiovascular death by exposure to NOx. Results: Between 1975 and 2007 over 4000 non-accidental deaths and over 2000 cardiovascular deaths occurred in the cohort, identified through the Swedish hospital discharge and cause specific death-registries. The risks of both were significantly associated with exposure to NOx (hazard ratios 1.12 and 1.15 in those with higher than median exposure compared to those with lower). Smoking and age were correlated with NOx-levels and thus true confounders reducing the hazard ratios. In a model including smoking, age, social class, body mass index, self-perceived stress and cholesterol levels the effect of NOx was only borderline significant. Discussion and conclusions: This indicates that exposure to NOx at residential address is associated with increased risk of cardiovascular and non-accidental mortality in this cohort of men in Gothenburg, but the increased risk is largely explained by age and smoking. This first preliminary analysis is based on initial exposure 1975. Yearly individual exposures 1975-2006 are being assigned and will be included in the final model, as well as further information on risk factors.

Abstract Number	**P-1-05-22**
Presenter	Kari Pasanen*, Eero Pukkala, Maria Myllynen, Tarja Koskentalo, Raimo O Salonen
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term exposure to wood smoke and mortality among urban population in the Helsinki Metropolitan Area

Background Residential heating with wood is a major local source of combustion-derived fine particles during the cold season in rural and urban communities in Europe. Long-term exposure to urban air fine particles is associated with cardiopulmonary mortality, but the role of wood combustion-derived particles is not known. Objectives We aimed to examine associations between estimated long-term exposure to wood smoke and cardio-respiratory mortality in suburban residential areas in the Helsinki Metropolitan Area, Finland. Methods We conducted a cohort study of 105, 000 people living mainly in single houses in the densely populated suburban areas, excluding areas with known interfering exposures. Registry data on person-years and mortality between 1981 and 2005 were assigned to small areas (250 m x 250 m grids) based on the residence location in 1980. Four categories of long-term exposure to wood smoke were defined using small area level statistics on the primary source of energy for residential heating in 1980. Relative risks (RR) of mortality, adjusted for age, sex, socioeconomic status, house density and estimated windiness, were calculated for each exposure category, using grids with the lowest exposure level as reference. Results The RRs for mortality from all diseases of the circulatory system by increasing exposure to wood smoke were 1.02 (95% confidence interval 0.94–1.09), 1.22 (1.12–1.34) and 1.20 (1.09–1.31) among men, and 1.03 (0.95–1.11), 1.05 (0.95–1.16) and 1.15 (1.04–1.26) among women. The risk estimates for mortality from respiratory diseases did not follow a regular trend; the highest RR (1.29; 1.04–1.60) among men was in the highest exposure category but among women in the second-highest category (1.29; 1.00–1.67). Conclusions Long-term exposure to wood smoke in densely populated suburban areas with mainly single houses was associated with increased mortality from circulatory diseases and respiratory diseases.

Abstract Number	**P-1-05-23**
Presenter	Michael Young*, Matthew Budoff, Temitope Foster, Jingzhong Ding, Joel Kaufman
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cross-sectional study

Nonalcoholic Fatty Liver Disease (NAFLD) and Long-Term Ambient Air Pollution Exposure: The Multi-Ethnic Study of Atherosclerosis (MESA)

Background: Animal studies have suggested that air pollution may cause metabolic changes including hepatic fat accumulation characteristic of insulin resistance in Type II diabetes. This outcome has not previously been assessed in relation to air pollution. Aims: We performed a cross-sectional analysis to estimate the association between long-term ambient NOx and PM2.5 and fatty liver, as measured via computed tomography (CT). Methods: The Multi-Ethnic Study of Atherosclerosis (MESA) is a population based cohort from 6 sites (n=6814). Participant exposures were annual average ambient PM2.5 and NOx concentrations estimated at year 2000 participant addresses using a likelihood-based land-use regression spatiotemporal model. The outcome was CT assessed liver density in Hounsfield units (HU), where liver attenuation less than 42 HU was considered to be non-alcoholic fatty liver disease (NAFLD). Logistic regression was used to assess the relationship between participant exposure and NAFLD. Individuals with excess alcohol consumption were excluded (men >14 drinks/wk and women >7 drinks/wk; remaining=6469). Primary models were adjusted for age at baseline, recruitment site, gender, race/ethnicity, educational attainment, BMI, waist circumference, smoking status, diabetes, HOMA-IR, HDL, and triglycerides. Results: Participants missing covariate values were excluded, resulting in a final sample size of 5558 for PM2.5 and 5484 for NOx. The adjusted OR of NAFLD for PM2.5 was 0.92 (95% CI: -0.84, 1.00) for a 1 µg/m3 difference in PM2.5 (p=.052). The adjusted OR for NOx was 0.99 (95% CI: 0.98, 1.00) HU for a 1 ppm difference in NOx (p=.24). Site-adjusted models with fewer covariates were non-significant. Liver attenuation was also evaluated as a linear outcome and the results were similarly non-significant. In contrast, the adjusted OR of NAFLD for untreated diabetes was 2.28 (95% CI: 1.35, 3.85) compared to non-diabetics (p < .01). Conclusions: Estimated air pollution exposure was not associated with fatty liver in this cross-sectional analysis.

Abstract Number	**P-1-05-24**
Presenter	Martine Dennekamp*, Muhammad Akram, Michael Abramson, Andrew Tonkin, Malcolm Sim, Karen Smith, Bircan Erbas
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Out-of-hospital cardiac arrests and hourly air pollution in Melbourne, Australia

Background The evidence regarding the association between short term (hourly) air pollution and acute cardiac events, such as out-of-hospital cardiac arrest (OHCA), is limited and inconsistent. Aims To investigate whether there is an association between hourly concentrations of air pollution and the incidence of out-of-hospital cardiac arrests in Melbourne, Australia Methods The study population comprised of 8434 cases who had an OHCA which was attended by ambulance personnel, between January 2003 and December 2006. These data were obtained from the Victorian Ambulance Cardiac Arrest Registry which recorded data on age, sex and the exact time (to the minute) of the emergency call. Hourly average PM2.5, PM10, O3, CO and NO2 were obtained from Environment Protection Authority Victoria. The data have been analysed using a case-crossover design with a time-stratified approach. Several lags were investigated and data were stratified by gender, time of day and three age groups. Results The increase in OHCA risk associated with PM2.5 in the hour of the arrest was estimated at 1.85% (95% CI 0.10 to 3.63%) per 5.7µg/m3 (Interquartile Range) increase in PM2.5 with males showing a stronger effect (2.89%, 95%CI 0.65 to 5.18). There was also a significant association between OHCA risk and O3 concentration in the hour of arrest for the males only (10.2% increase in risk, 95%CI 1.72, 19.3%, per 16 ppb [IQR] increase in O3). Stratification by age group for PM2.5 showed the largest effect size in the age group 65–74 years (6.3 95%CI 2.2, 10.6 for an IQR increase). Conclusions Hourly PM2.5 and Ozone concentrations are associated with an increase in OHCA risk in Melbourne, Australia.

Abstract Number	**P-1-05-26**
Presenter	Hye Yin Park*, Sanghyuk Bae, Yun Chul Hong
Exposure	ambient air pollution
Health domains	other
Type of research	meta-analysis

PM10 Exposure and Non-accidental Mortality in Asian Populations: A Meta-analysis of Time-series and Case-crossover Studies

Background: Associations between air pollution and daily mortality outcomes have been well-documented, and among the ambient air pollutants, particulate matter (PM) has shown the most consistent associations with mortality. Also, with the different meteorological and socio-demographic conditions, need studies on Asian countries has been emphasized. Aims: We investigated the association between particulate matter less than 10 µm in aerodynamic diameter (PM10) exposure and non-accidental mortality in Asian populations by meta-analysis, using both time-series and case-crossover analysis. Methods: Among the 819 published studies searched from PubMed and EMBASE using key words related to PM10 exposure and nonaccidental mortality in Asian countries, 8 time-series and 4 case-crossover studies were selected for meta-analysis after exclusion by selection criteria. We obtained the relative risk (RR) and 95% confidence intervals (CI) of non-accidental mortality per 10 µg/m3 increase of daily PM10 from each study. We used Q statistics to test the heterogeneity of the results among the different studies and evaluated for publication bias using Begg funnel plot and Egger test. Results: Testing for heterogeneity showed significance (p=0.0002); thus, we applied a random-effects model. RR (95% CI) per 10 µg/m3 increase of daily PM10 for both the time-series and case-crossover studies combined, time-series studies only, and case-crossover studies only, were 1.0047 (1.0033 to 1.0062), 1.0057 (1.0029 to 1.0086), and 1.0027 (1.0010 to 1.0043), respectively. The non-significant Egger test suggested that this analysis was not likely to have a publication bias. Conclusions: We found a significant positive association between PM10 exposure and non-accidental mortality among Asian populations. Continued investigations are encouraged to contribute to the health impact assessment and public health management of air pollution in Asian countries.

Abstract Number	**P-1-05-27**
Presenter	Ondine von Ehrenstein*, Hilary Aralis, Jiaheng Qiu, Pei Chen Lee, Beate Ritz
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cohort study

Prenatal Exposure to Air Toxics and Autism in Children

Background: While genes are involved in the development of autism, findings are emerging for a possible role for the environment. Yet, knowledge about specific environmental risk factors for autism remains scarce. Recently, studies suggested increased risk related to traffic related air pollution. Aims: To examine for the first time associations between prenatal exposures to measured concentrations of ambient air toxics and autism in children. Methods: This analysis includes successfully geocoded Los Angeles County term births 1995-2006 whose mothers resided <5 km from a government monitoring station (n= 132,323). Autism cases (n=654) aged 36-71 months were identified through records maintained by the California Department of Developmental Services and linked to their respective birth records. We derived multiple air toxics' measures using government monitoring stations (e.g., benzenes, poly-aromatic hydrocarbons, organic solvents) in the Los Angeles air basin, and created pregnancy period specific exposure estimates. We examined patterns of exposure using factor analysis, and associations between toxics and autism with logistic regression. Results: Exposure during pregnancy to several air toxics increased odds ratios (OR) for autism, including benzene [per interquartile-range increase] (OR: 1.46; 95% CI: 1.09, 1.95), 1,3-butadiene (1.57; 1.12, 2.19), and meta/para-xylene (1.56; 1.27, 1.92) after adjusting for a range of covariates, including year of birth, maternal race/ethnicity, age, parity, child gender, and insurance type. Conclusions: Our preliminary findings suggest increased ORs for autism in children with prenatal exposure to several air toxics, including industry and traffic related pollutants, at current ambient air concentrations. This finding provides support for the urgent need of reduction of ubiquitous toxic air pollution exposures to prevent the development of autism.

Abstract Number	**P-1-05-28**
Presenter	Jessica Mendoza-Ramirez*, Albino Barraza-Villarreal, Octavio Hinojosa de la Garza, Luisa Torres-Sanchez, Leticia Hernandez-Cadena, José Luis Texcalac Sangrador, Marlene Cortez-Lugo, Luz-H Sanín, Isabelle Romieu
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Prenatal Exposure to Nitrogen Oxides and Birth Weight in Mexican Infants

Introduction: the mother-child pairs is potentially susceptible to the toxic effects of pollutants, because some chemicals have the potential to interfere with placental transfer of nutrients and affect the product. Objective: To evaluate the impact of prenatal exposure to nitrogen oxides on birth weight in a cohort of infants from Morelos, Mexico. Material and methods. The study included 730 infants-mother pairs participating in the cohort study. Information on socio-demographic characteristics, medical, health history and environmental exposure during pregnancy was collected and anthropometric measures at the moment of delivery were obtained. The prenatal exposure assessment to nitrogen oxides (NOx) was estimated using a land-use regression model considering local monitoring in 60 sites of the state of Morelos. We ran multiple linear regression models adjusted for confounder variables to evaluate the association. Results: The mean of NOx concentrations was of 21.28ppb. The mean of birth weight was 2700 ± 437.6 g. We found a negative statistically significant association between prenatal exposure to NOx and birth weight, an increase of one interquartile range of 6.95 ppb of NOx the birth weight decreased 37.80g, adjusted by confounder variables. Conclusions: Our results support the hypothesis that prenatal exposure to NOx has a negative impact on birth weight, which can influence the future growth and development of the neonate.

Abstract Number	**P-1-05-29**
Presenter	Maria Harris*, Diane R. Gold, Sheryl Rifas-Shiman, Steven Melley, Lenie van Rossem, Petros Koutrakis, Joel D. Schwartz, Brent A. Coull, Antonella Zanobetti, Sharon K. Sagiv, Emily Oken
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to traffic-related pollution and childhood cognition

Background: The prenatal period is a critical window for neurodevelopment. Recent research suggests that prenatal exposure to traffic-related pollution may negatively impact the developing brain, impairing childhood cognition. Aims: Examine prenatal exposure to traffic and related pollutants and performance on neurodevelopment tests among 1146 children in the Project Viva prospective pre-birth cohort. Methods: We assessed residential proximity to major roadways (class A1 or A2, e.g. state or interstate highways) at study enrollment (median 10.0 weeks gestation). We also estimated residential exposure to black carbon (BC) during the third trimester using a temporally- and spatially- resolved model. At mean age 8.0 (range 6.6-10.9) years, we measured children's verbal and non-verbal intelligence using the Kaufman Brief Intelligence Test and executive function using the Behavior Rating Inventory of Executive Function (teacher reported). We used linear regression to examine associations of categorical ranges of road proximity and quintiles of BC exposure with continuous test scores, adjusted for characteristics of the child (age and sex), mother (race/ethnicity, prenatal smoking, education, and IQ), household (income and HOME score) and neighborhood (% below poverty). BC models were also adjusted for year and season of birth. Results: In multivariate models, compared with those >50m from a major roadway, children whose mothers lived within 50m of a major roadway in pregnancy (n=41) had lower verbal IQ (-3.8 points, 95% confidence interval (CI): -8.1, 0.4), non-verbal IQ (-5.6 points, 95% CI: -11.1, -0.2), and somewhat poorer executive function (2.9 points, 95% CI: -1.1, 7.0). We observed no consistent patterns in outcomes across quintiles of third trimester BC exposure. Conclusions: Residential proximity to major roadways during gestation was associated with lower IQ at school age, but modeled third trimester BC exposure did not predict lower cognitive

Abstract Number	**P-1-05-30**
Presenter	Julia Vishnevetsky, Virginia Rauh, Hsin-Wen Chang, Shuang Wang, Julie Herbstman, Deliang Tang, Frederica Perera*
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	cohort study

Prenatal Polycyclic Aromatic Hydrocarbon (PAH) Exposure, Maternal Hardship and Child IQ at age 7

Background: Polycyclic aromatic hydrocarbons (PAH) are a common urban air pollutant. We previously reported that prenatal PAH exposure was associated with lower IQ scores at age 5. It is known that people of lower socioeconomic status are often exposed to a greater number of environmental health hazards, including air pollution and environmental toxins, than are people with more financial resources. Aims: We examined the interaction of PAH and material hardship on IQ in children at 7 years of age in order to assess whether material hardship exacerbated the association between PAH exposure and IQ scores. Methods: Children of African-American and Dominican women in New York City were followed to age 7. We measured PAH-DNA adducts in cord blood to estimate prenatal PAH exposure. Material hardship was self-reported prenatally, and at 6, 12, 24, 36, and 60 months. At age 7, we assessed child IQ via the Wechsler Intelligence Scale for Children (WISC). We ran main effects models with cord adducts and hardship to determine their association with IQ. Then, we used linear models on the WISC scores with an interaction term for adducts and hardship, with separate models for prenatal and cumulative hardship through age 5. Results: A total of 239 children had cord adduct measurements, material hardship information, WISC assessments and the accompanying covariates. Prenatal exposure to PAH and material hardship were independently inversely associated with Full Scale IQ ($p=0.08$ and 0.01, respectively). We also observed an interaction of prenatal PAH exposure and cumulative hardship through age 5 on Working Memory scores ($p<0.01$) such that children with high prenatal PAH exposure and high material hardship had significantly lower scores on the WISC than did children without these exposures. Conclusion: These results suggest that both prenatal PAH exposure and material hardship from birth to age 5 are independently negatively associated with Full IQ at age 7. However, their combined effect on Working Memory at age 7 is greater than the effect of each factor alone.

Abstract Number	**P-1-05-31**
Presenter	Ward-Caviness Cavin*, Colette Blach, Carol Haynes, Prakash Bhave, Robert B. Devlin, David Diaz-Sanchez, Svati Shah, Marie Lynn Miranda, William Kraus, Elizabeth Hauser, Lucas M. Neas
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-control study

Prevalence of hypertension increases exponentially with proximity to roadways in an adult cardiac catheterization cohort

Background: Previous epidemiologic studies have suggested that residential proximity to traffic increases cardiovascular disease risk factors and endophenotypes in major urban areas. Objectives: We examined the associations between mobile source air pollution and hypertension in an environment less urban than the major metropolitan areas previously studied. Methods: We utilized a cohort of 2,123 patients with outpatient cardiac catheterization at the Duke Cardiac Catheterization clinic (CATHGEN), who resided within Durham, Wake, or Orange Counties, North Carolina. We computed the inverse exponential distance to the nearest primary or secondary roadway. Associations were examined using generalized additive models adjusting for sex, race, smoking and socioeconomic status (median home value). We further adjusted for the annual average of PM2.5 in a subset of these patients (N = 1,806). Odds ratios (OR) and confidence intervals (CI) were calculated per interquartile range decrease in distance to roadways. Results: Hypertension prevalence showed an inverse exponential association with distance to primary or secondary roadway in an unadjusted model (OR = 1.21, 95% CI: 1.06 – 1.37). A full model adjusted for race, sex, smoking, and median home value only slightly attenuated the association (OR = 1.17, 95% CI: 1.03 – 1.33). Additional adjustment of the full model for background PM2.5 (annual average) using the EPA's Fused Air Quality Surfaces Using Downscaling data had no meaningful effect on the association (OR = 1.21, 95% CI: 1.05 – 1.40). Conclusions: Even in less urban environments, hypertension was associated with proximity to major roadways. This association was independent of the annual average PM2.5 at the census tract level for each residence. This proposed abstract does not necessarily reflect EPA policy

Abstract Number	**P-1-05-32**
Presenter	Ana M. Vicedo-Cabrera*, Dolores Catelan, Laura Grisotto, Franca Rusconi, Neil Pearce, Fabio Barbone, Annibale Biggeri
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Respiratory disorders and air pollution in children living in the High Risk Area of Milazzo – Valle del Mela (Sicily).

Background: Acute effects of air pollution on children's respiratory health status have been described, but the association with chronic exposure is less clear. Aim:to investigate the association between the individual long-term exposure to ambient air pollutants, and respiratory disorders in children living in the high risk area of Milazzo-Valle del Mela (Sicily, Italy). Methods:A cross-sectional survey was carried out among all the 6 to12-years-old children attending primary schools using the SIDRIAS-II questionnaire. SO2 and NO2 were measured in every school by passive dosimeters (November 2007 - April 2008). A Universal Bayesian Kriging approach was performed to predict individual exposure at residential addresses. Crude, adjusted odds ratios (cOR/aOR) and 95% CI were evaluated. All analyses were repeated by weighting for the inverse variance of the predictions. Results: The predicted mean level was 25.78 (± 10.61) for NO2 and 4.10 (± 2.71) µg/m3 for SO2. With an effective sample size of 1,682 children, prevalence of current wheezing, persistent cough, asthma symptoms and severe asthma of 10.5%, 2.9%, 15.7% and 3.8% were reported. Associations for single pollutants (above/below the median value) and weighted for prediction uncertainty were: current wheeze NO2: OR 1.1 [95%CI 0.7-1.6], SO2: 0.9 [0.6-1.4]; persistent cough NO2: OR 2.0 [0.8-4.6], SO2: 2.9 [1.2-7.1]; asthma symptoms NO2: OR 1.1 [0.7-1.6], SO2: 1.2 [0.8-1.8]; severe asthma NO2: OR 0.9 [0.5-1.6], SO2 1.0 [0.5-1.8]. For NO2 using a cut-off of 40 µg/m3 – the WHO and European limit – we found larger associations (aOR weighted: 5.2 [2.0-13.8]). Conclusion: Weighting by prediction uncertainty, we found consistent risk estimates for persistent cough and high exposure to NO2, while for SO2 they are more unstable. It was very difficult to disentangle the effect of NO2 from those of SO2.

Abstract Number	**P-1-05-33**
Presenter	Qingyu Meng*, Robert Laumbach, Pamela Ohman-Strickland
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Respiratory Effects of Ozone and Acidic Aerosol for Children in an Urban Community

Background: Ozone is one of the six criteria air pollutants, which can cause various adverse respiratory effects. There are discrepancies between the findings from controlled human exposure studies and environmental epidemiologic studies. Adverse respiratory effects have been reported at lower ozone concentrations in epidemiologic studies than in controlled human exposure studies. Different exposure conditions can cause the inconsistent findings in controlled human studies and environmental epidemiological studies. Ozone health effects can be modified by co-exposure to other air pollutants and meteorological conditions. Aims: We will study 1) the impacts of aerosol acidity on the associations between ozone exposure and FEV1 and FENO, and 2) the impacts of ambient temperature and humidity on the associations between ozone exposure and FEV1 and FENO. Methods: Twenty children (9-14 years old) with asthma, living in downtown Newark, NJ participated in this study. Each child was followed for 10 consecutive days. On each day, real-time 5-min average personal ozone concentration, ambient 24-hr integrated aerosol acidity, and 5-min average ambient temperature and relative humidity were measured. FEV1 measured three times per day for each child, and FENO measured once per day for each child. Linear mixed models were used to find the associations between ozone exposure and FEV1 or FENO. The effect modification of aerosol acidity and ambient meteorological conditions were also examined. Results: Preliminary analyses show that ozone concentrations in the study area ranged from 20 to 60 ppb. Personal exposure to ozone was not well correlated with ambient ozone concentrations. Ambient aerosol acidity was less than 80 nmol/m3 of H+. Negative association between ozone exposure and lung function change was observed. Conclusions: The study first reported the associations between asthma exacerbation and lung function change, modified by copollutant exposures and meteorological parameters.

Abstract Number	**P-1-05-34**
Presenter	Eric Rasmuson, Andrey Korchevskiy*, Jim Rasmuson
Exposure	others
Health domains	cancer
Type of research	exposure modeling

Retrospective Exposure Reconstruction: Reverse Models of Asbestos Health Risk Assessment

Background. In the 21st century, asbestos remains a serious and somewhat controversial occupational and environmental hazard. Asbestos-related cancer claims remain the number one toxic tort issue in the world. The development of effective risk assessment approaches for different types of asbestos fiber types is critical to address the existinguncertainty in some exposure evaluation methods. Retrospective exposure reconstruction is tightly connected to risk assessment methodologies. From the scientific viewpoint, exposure reconstruction can be perceived as a reverse model of risk assessment when exposures are evaluated based on the observed health outcomes. Aims. To review improvedasbestos exposure reconstruction methodologies in epidemiology studies and resulting health risk assessment models. To discuss validation and characterization methods of individual and cohort asbesos exposure assessments, based on consistency of mesosthelioma mortality rates. Methods. The reverse versions of the most famous asbestos health risk assessment models (U.S. EPA IRIS, Hodgson and Darnton, Berman and Crump) were applied to mesothelioma mortality data in 19 published cohorts to reconstruct the levels of exposure. Monte Carlo simulation was utilized to reflect the variability of mortality rates and the coefficients of the models. Results. It was demonstrated that the results of exposure reconstruction were consistent with the published exposure levels if the fiber type difference was taken into consideration (correlation coefficients r=0.88 for Berman, Crump model, r=0.82 for Hodgson and Darnton model, P<0.05). Conclusions. The application of reverse models of asbestos risk assessment can play an important role in retrospective exposure reconstructions. Further development is needed, with cross-validation and utilization of additional sources of information, like lung burden measurements and refined evaluation of the morphology of asbestos fibers for different occupational conditions.

Abstract Number	**P-1-05-35**
Presenter	Rémy Slama*, Lise Giorgis-Allemand, Claire Bernard, Marie Pedersen, Rob Beelen, Mark J Nieuwenhuijsen, Göran Pershagen, Bert Brunekreef, Manolis Kogevinas, Escape ESCAPE Birth Outcomes working group
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	meta-analysis

The Influence of Atmospheric Pollutants on the Length of Human Gestation

Context: Preterm delivery is the adverse pregnancy outcome entailing the largest disease burden on the short and long term. Exposure to atmospheric pollutants is one of the suspected risk factors with the highest prevalence. Aim: Our aim was to characterize the impact of atmospheric pollutants on preterm delivery (before 37 completed gestational weeks). Methods: We harmonized and pooled individual data from 13 cohorts (64,221 births) in 12 European countries, as part of ESCAPE project. Since air pollution may affect early fetal growth, whenever possible, we defined preterm delivery using conception date estimated from the last menstrual period rather than from fetal ultrasonography. We conducted nitrogen oxides (NO2, NOx) and particulate matter (PM) monitoring campaigns in all study areas, whose measures were combined to permanent monitoring stations, traffic and land-use data to develop a seasonally-adjusted Land Use Regression exposure model. Exposures were averaged during gestational weeks 3-37. Pregnancy-specific exposure effects on preterm delivery risk were estimated in each center by logistic regression adjusted for potential confounders (including maternal height and weight and active smoking) and combined by meta-analysis. Results: The overall prevalence of preterm delivery was 5.0%. Smoking was associated with an increased risk of preterm birth. An increase by 5 ug/m3 in PM2.5 pregnancy level (5th-50th-95th centiles, 8.8-15.7-25.0 ug/m3) was not associated with risk of preterm delivery (adjusted odds-ratio, 0.93; 95% CI, confidence interval, 0.84-1.03, 2434 cases). Similarly, NO2 and NOx pregnancy levels were not associated with risk of preterm delivery. Discussion: Our cohort-based harmonized meta-analysis does not suggest an adverse effect of whole pregnancy exposure to atmospheric pollutants on preterm delivery. The constituted database will allow investigating possible heterogeneity between areas and consider pooled analyses as well as shorter exposure windows.

Abstract Number	**P-1-05-36**
Presenter	Fanny Rancière*, Lydia Nikasinovic, Isabelle Momas
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Traffic-related air pollution, susceptibility and respiratory symptoms in preschoolers: results from the PARIS birth cohort

Background: Associations between exposure to traffic-related air pollution (TAP) and respiratory symptoms in preschoolers have been widely studied but remain inconsistent. A possible explanation is the existence of effect modifiers, such as atopic status. Recently, a few studies have suggested that children experiencing psychological stress were more vulnerable to TAP exposure. To date, no study has jointly considered the effects of TAP, atopy and psychosocial factors on the development of childhood asthma and allergy. Aims: To study whether parental history of allergy and occurrence of life events, separately and combined, modify the effect of TAP exposure on respiratory morbidity in preschool children. Methods: Children from the PARIS birth cohort followed up to 4 years of age were considered in the present study. Health outcomes such as wheezing, dry night cough and rhinitis symptoms, as well as familial life events such as separation/divorce, unemployment and serious health problems were regularly collected using self-administered questionnaires all along the first 4 years of life. Children's early individual exposure to TAP was assessed during the first year of life using a dispersion model, taking into account both homes and daycare places. Results: Exposure to TAP was significantly associated with an increased risk of persistent wheezing at 4 years of age. There was no association with other symptoms. The analyses conducted in children separated according to familial life events, parental history of allergy, or both familial life events and parental history of allergy revealed that exposure to TAP was associated to the occurrence and persistence of wheezing, dry night cough and rhinitis symptoms in the first 4 years only in children with both familial life events and parental history of allergy. Conclusions: These results suggest that familial life events and parental history of allergy modify the effects of TAP in preschool children, especially with regard to the persistence of respiratory symptoms.

Abstract Number	**P-1-05-37**
Presenter	Alexandra Schneider*, Susanne Breitner, Regina Hampel, Wojciech Zareba, Josef Cyrys, David Q Rich, Annette Peters
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Ultrafine particles induce rapid changes in repolarization in individuals with impaired glucose metabolism

Background: Considerable evidence from numerous studies has led to the consensus that particulate matter (PM) mass concentrations are associated with adverse cardiovascular effects. However, for particle number metrics such as ultrafine particles (UFP, diameter <0.1µm) the role is still not clear. Aims: We investigated the effects of different ambient particle mass and number metrics on repolarization parameters on an hourly basis. Methods: Sixty-four individuals with type 2 diabetes and impaired glucose tolerance participated in a panel study in Augsburg, Germany, between Mar 2007 and Dec 2008. Ambulatory ECG measurements were conducted on up to 4 occasions over up to 6 hours. Repolarization parameters (corrected QT-interval (QTc), T-wave amplitude (Tamp) and T-wave complexity (Tcomp)) were determined on an hourly basis. Hourly measurements on different particle mass and number size fractions were available from a central measurement site. Additive mixed models with a first-order autoregressive covariance structure adjusting for meteorology were applied. Effects are presented as %-change of outcome mean per interquartile range increase of the respective pollutant together with a 95%-confidence interval. Results: We observed decreases in QTc with UFP [-0.16 (-0.32; 0.00)] and especially with particle number counts of size classes 10-30nm and 30-50nm after 3 hours. Tamp also showed a decrease after 3 hours for the same size classes [for UFP: -0.92 (-1.65; -0.19)] as well as for size class 50-100nm. Moreover PM2.5 (diameter <2.5µm) and PM10 (diameter <10µm) were associated with decreases in Tamp within 3 hours. With a delay of 6 hours Tcomp increased in association with UFP [1.77 (0.26; 3.31)], as well as with particle number counts of size classes 30-50nm and 50-100nm. Conclusions: This study provides evidence suggesting very immediate effects of ultrafine particles on repolarization duration and morphology, key factors in the mechanisms of cardiac death.

Abstract Number	**P-1-06-01**
Presenter	Kashima Saori*, Takashi Yorifuji, Sanghyuk Bae, Yasushi Honda, Toshihide Tsuda, Hiroyuki Doi, Yun-Chul Hong
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Asian dust and daily mortality in Korea and Japan

Background: Asian dust spreads to wide areas of Asian countries. The chemical components of the dust are not fully understood, and may be complex, including pollutants from urban emissions. Desert dust is considered to have a potential toxicity and such toxicity can change during long-range transportation. The independent effects of desert dust in different location, however, have still been less clear in Asian countries. Aims: We evaluated adverse-health effects of Asian dust event on cause-specific mortality independent of particulate matter in Korea and Japan. Methods: We obtained daily mean concentrations of Asian dust as well as particulate matter between 2005 and 2010. Asian dust was obtained from Light Detection And Ranging (LIDAR) by National Institute for Environmental Studies, Japan. We then evaluated city-specific [Seoul (Korea), Matsue, Osaka, and Tokyo (Japan)] associations of Asian dust with daily mortality for all age groups using a time-series analysis. Study periods were different between each city due to data availability. Results: The mean (and maximum) concentration of Asian dust in Seoul, Matsue, Osaka, and Tokyo were 15.4 µg/m3 (max 444.4 µg/m3), 26.6 (458.7), 7.7 (121.6), and 9.5 (123.8), respectively. The positive associations of Asian dust with all-cause or cause-specific mortality were observed even after we adjusted for particulate matter in the same model. The excess risk following 10 µg/m3 increase of Asian dust was 0.5% (95% CI 0.1–0.1) for all-cause mortality in Seoul (mean of lag 0–4). In addition, the excess risks for cerebrovascular disease mortality (lag 1) following 10 µ/m3 increase of Asian dust were 0.6% (95% CI -0.1–1.4) in Seoul, 4.0% (95% CI 0.1–8.0) in Matsue, 3.8% (95% CI 0.3–7.4) in Osaka, and -1.3% (95% CI -3.6–1.1) in Tokyo, respectively. Conclusions: Adverse health effects on all-cause and cerebrovascular disease mortality were observed in Seoul and Western part of Japan.

Abstract Number	**P-1-06-02**
Presenter	Oksana Ananyeva*, Olena Turos, Arina Petrosian, Liliia Petruk, Liudmyla Mykhina, Tatiana Maremukha
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Assessment of Exposure to Traffic-Related Air Pollution in Residential Neighborhood

Traffic-related air pollution is one of major factors predetermining the public health safety in modern cities. This study aims at improvement of exposure assessment to traffic-related air pollution in human health studies. A field campaign was conducted from June to October 2012 to measure traffic-related air pollution including particular matter (TSP, PM10, PM2,5, PM1), particle number, NO2, CO, CO2 and meteorological factors in the urban settlement of Darnytskyi district of Kyiv city. Contemporaneous 1- to 20-minute average personal breathing zone concentrations were measured for all pollutants simultaneously during the morning and evening rush-hours at different distances from studied roads and intersections (at 25-50 m, e.g. parks, bus stops, playgrounds, near residential buildings). Vehicle fleet intensity and major parameters of the study area were registered for each location. Additional studies on identification of metals in PM dust were conducted with X-ray fluorescence spectrometer. Pollutants concentrations exhibited substantial spatial variation consistent with roadway intensity, fleet composition, meteorological factors, proximity to general public places and type of residential development. Pollution levels exceeding national air quality standards were observed for CO and CO2: from 0.12 to 8.58 mg/m3 and from 619.30 to 1951.57 mg/m3 respectively. Other pollutants concentrations ranged: from 43.0 to 137.0 mkg/m3 for NO2 and from 26.0 to 200.0 mkg/m3 for TSP. The highest particular matter levels were at: 42.0 – 70.8 (mean: 50.4±5.4) mkg/m3 for PM10, 32,2 – 42,0 (mean: 36,9±1,8) mkg/m3 for PM2,5, 30.3 – 39.4 (mean: 34.5±1.6) mkg/m3 for PM1. Metals were identified in 98% of the analyzed PM samples. The results revealed the interrelationship between variation of polution levels and external parameters of the study domain. Our future work will focus on development of regression models based on the data obtained in field studies and further improvement of exposure assessment methods.

Abstract Number	**P-1-06-04**
Presenter	Mei Chung*, Christina Fuller, Kevin Lane, Doug Brugge
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Blood pressure is associated with same day PNC from a central site monitor for a population most of whom live near a major highway

Background: Studies have shown various degrees of acute effects of air pollution on systolic and diastolic blood pressure (SBP; DBP) as well as pulse pressure (PP). Aim: To examine the associations between SBP, DBP, and PP and the same day particle number concentration (PNC), and potential modifiers such as obesity and preexisting hypertension. Methods: Multivariate linear regression analyses (using SAS® Mixed model) were performed in 213 out of 270 participants over 40 years of age, were analyzed most of whom lived near a major highway in two study areas in the Boston, MA area. Participants had automated SBP and DBP measurements at clinic visits in the Community Assessment of Freeway Exposure and Health (CAFEH) study. PNC was measured at a central site about 7 km away from the study areas. Daily averages of PNC (number/cm3) were created using means of the hourly data. Results: The mean (range) of daily PNC was 16,391 (6,908 to 29,530) across the days when blood pressure measures were obtained in the analytic sample. The mean (range) of SBP, DBP, and PP were 135 (91 to 191), 78 (46 to 107), and 57 (29 to 114) mmHg, respectively. Same day PNC was positively associated with SBP (P=.006) and PP (P=.018) but not DBP (P=0.20), after controlling for age, gender, race, education, income, smoking, statin medication, hypertension, and obesity. A 5,000 unit increase in PNC was associated with increases in mean SBP (SE) 2.21 (0.81) and PP 1.56 (0.65) mmHg. On average, obese participants had higher blood pressure than non-obese participants. There was a significant interaction between obesity and hypertension (P=0.003) for the association between PNC and DBP, but not for the other two models. Conclusions: Our findings suggest a possible link between particle number concentration and systolic blood pressure, diastolic blood pressure and pulse pressure, but many factors may modify the associations.

Abstract Number	**P-1-06-05**
Presenter	Nicholas Good*, Maggie L. Clark, Ashleigh Kayne, Kirsten A. Koehler, Christian L'Orange, Brianna Moore, Amy Stuart, Jennifer L. Peel, John Volckens
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Commuting and air pollution: A multi-pollutant exposure study

The Fort Collins Commuter Study is a five-year project that will assess personal air pollution exposure and indicators of acute subclinical health responses to airborne pollution. The study examines exposures to multiple air pollutants during 30-hour periods of continuous personal monitoring, enabling the relative contributions of multiple activities to be assessed. Given that road traffic is a major source of air pollution, exposure during commuting may make up a substantial fraction of a person’s daily exposure. The first aim of the Fort Collins Commuter Study is to examine how the choice of commuting route and transport mode impacts exposure. Fifty participants are being recruited into the study. Each commuter is completing eight full days of exposure assessment and is randomized to travel by car and by bicycle from their home to their workplace and follow pre-arranged nominally higher and lower traffic routes. The result is a total of 400 commute-days of exposure data. Each commuter carries a backpack containing monitoring equipment and is fitted with a personal heart rate and activity monitor. Exposure to black carbon, particulate matter, carbon monoxide, particle number concentration, nitrogen dioxide, volatile organic compounds and noise are being measured. The location of the commuter is recorded using a GPS receiver. The results presented will examine how route and transport mode impacts commuter exposure to multiple pollutants. The relative contribution of exposure during commuting will be assessed in the context of the total daily exposure. Initial results suggest commuting can often be a substantial contributor to daily total personal exposure, but other activities can also be dominant factors. Typical exposure levels during commutes have ranged from 5 to 30 micrograms per cubic meter for PM2.5 and 1 to 10 micrograms per cubic meter for black carbon.

Abstract Number	**P-1-06-06**
Presenter	Thomas Cole-Hunter*, Nadine Kubesch, David Martínez, Marta Cirach, Jordina Belmonte, Audrey de Nazelle, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Effect of short-term pre-exposure to ambient biological aerosols, anthropogenic pollutants and noise on cardiopulmonary health baseline parameters

Background: Exposure to ambient air pollution is known to affect some health outcomes (such as asthma exacerbations and cerebrovascular accidents); however, findings on short-term effects have been inconsistent, which has important implications for baseline measurements in experimental studies of acute health effects. Aims: The current study aimed to investigate the 3-day pre-exposure lag effect of ambient bioaerosols, anthropogenic pollutants and noise on cardiopulmonary baseline measurements in an experimental acute health effect study (as part of the TAPAS project). Methods: Participants (N = 31; 58% female) had their home and work addresses geo-coded for spatiotemporal modeling of nitrogen oxides (NOX) and fine particulate matter (PM2.5), and temporal modeling of bioaerosols and noise, which were associated with baseline parameters of spirometry (FEV1, PEF), exhaled nitric oxide (eNO), blood pressure and pulse. Health baseline parameters were collected from each participant on four different occasions and analysed via multivariate-adjusted linear mixed modeling. Results: FEV1 was associated with 2-day-lag NOX and PM2.5 ($p = 0.036, 0.034$), and eNO with 3-day-lag NO2, NOX, PM2.5 ($p = 0.003, 0.015, 0.007$) levels. Further, FEV1 was associated with 1-day-lag Palmeres ($p = 0.023$), and with 3-day-lag Chenopodiaceae and Cupressaceae ($p = 0.019, 0.033$) pollen levels. PEF was associated with 2-day-lag Artemisia and Chenopodiaceae ($p = 0.005, 0.018$) levels. eNO was associated with 1-day-lag Olea and Alternaria ($p = 0.027, 0.028$) levels. Systolic and diastolic blood pressure were associated with 3-day-lag PM2.5 ($p = 0.031, 0.034$) and NOX ($p = 0.018, 0.014$) levels. Further, associations were seen with pulse and 0-day and 3-day-lag PM2.5 ($p = 0.046, 0.034$), NO2 ($p = 0.040, 0.015$) and noise ($p = 0.006, 0.004$) levels. Conclusions: Pre-exposure to NOX, PM2.5, various bioaerosols and noise may compromise measurement of cardiopulmonary baseline parameters, especially in short-term experimental research of specific acute health effects.

Abstract Number	**P-1-06-07**
Presenter	Rupa Basu*, Maria Harris, Lillian Sie, Brian Malig, Rachel Broadwin, Rochelle Green
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Effects of fine particulate matter and its constituents on low birth weight among full-term infants in California

Background: Prenatal exposure to fine particles (PM2.5) and low birth weight (LBW; <2,500 grams) has been described previously. Very few studies have considered the constituents of PM2.5, which may be indicators of potential sources and major contributors of risk. Aim: To examine the effects of prenatal exposure PM2.5 total mass and 23 PM2.5 constituents on birth weight among term births. Methods: We estimated trimester and full gestational exposures of PM2.5 mass and PM2.5 constituents for a cohort of 650,797 births occurring in California within 20 kilometers of one of eight PM2.5 constituent monitors between 2000 and 2006. We used linear and logistic regression models to assess associations between exposures and term birth weight and percent increase in risk of term LBW, respectively. Models were adjusted for region, gestational age, individual demographic characteristics, apparent temperature during pregnancy, and month and year of birth. We also performed sensitivity analyses adjusting for zip code level socioeconomic indicators. Results: PM2.5 mass and nearly all PM2.5 constituents appeared to be significantly associated with a reduction in term LBW for full pregnancy exposure. The largest decreases in weight per IQR increase in PM 2.5 constituent were observed for vanadium, sulfur, sulfate, iron, elemental carbon, manganese, titanium, bromine, ammonium, copper, zinc, and nitrate. Several of these PM2.5 constituents also had associations with increased risk of term LBW. Reductions in birth weight tended to be larger among younger mothers and varied by race/ethnic group. Conclusions: Exposure to specific constituents of PM2.5, especially traffic-related particles, sulfur species, and metals, were associated with increased risk of LBW in California.

Abstract Number	**P-1-06-08**
Presenter	Perry Hystad, Paul J Villeneuve*, Mark Goldberg, Richard T. Burnett, Kenneth C Johnson
Exposure	ambient air pollution
Health domains	cancer
Type of research	case-control study

Exploring Associations between Traffic-Related Air Pollution and Female Breast and Prostate Cancer using a Multi-Site Population-Based Case-Control Study in Can

Background: Recent studies have reported positive associations between exposure to traffic-related air pollution and breast and prostate cancer incidence; however, few studies have been conducted and the findings are mixed. Methods: We used the National Enhanced Cancer Surveillance System, a population-based case-control study conducted in 8 of 10 Canadian provinces from 1994 to 1997. Our analyses are based on 1,829 post-menopausal incident breast cancer cases and 2,432 female controls, and 1,763 incident prostate cancer cases and 2,477 male controls. Residential histories over a 20 year period were used with a geographic information system to estimate urbanicity, population density, and road proximity measures. Long-term nitrogen dioxide (NO2) exposure measures were estimated from fixed-site air pollution monitors as well as spatiotemporal modeling methods. We calculated odds ratios (ORs) using logistic regression and adjusted for several known and suspected risk factors from self-reported questionnaires for each cancer site. Results: Preliminary analyses showed no consistent associations between breast cancer and long-term exposure measures, including years residing in large urban areas, average population density within 1, 5 and 10 km's of residences, proximity to major roads, and measured and modelled NO2 exposure. For example, the odds of breast cancer associated with a 10 ppb increase in modelled NO2 exposure was 1.07 (95% CI: 0.88-1.28). Similarly for prostate cancer, no associations were observed with years residing in large urban areas and average population density within 1, 5 and 10 km's of residences. Increased associations were observed for prostate cancer and 10 ppb increases in measured (OR: 1.11; 95% CI: 0.92-1.33) and modelled (OR: 1.12; 95% CI: 0.96-1.31) NO2, although the results varied by province. Conclusions: No consistent associations were observed between traffic-related air pollution measures and post-menopausal breast cancer incidence, while some evidence was seen for increased associations for prostate cancer incidence.

Abstract Number	**P-1-06-09**
Presenter	Magda Cristina Cepeda Gil*
Exposure	ambient air pollution
Health domains	physical activity
Type of research	review

EXPOSURE TO AIR POLLUTION DUE TO ACTIVE TRANSPORTATION: PROBLEM OF RISK / BENEFIT TO HEALTH. SYSTEMATIC REVIEW.

Background Recent controversy has risen regarding the risks related to exposure to environmental hazards like air pollution, secondary to active transportation in public areas. Although it is an important source of daily physical activity, is unclear the risk/benefit balance of active transportation in health at short and long term, when expositions are considered. Aim The study aimed to describe the evidence about the evaluation of exposure to air pollution comparing motorized to active transportation. Methods A systematic search was conducted, by reviewing literature published in English and Spanish in electronic databases, between 2000 and 2012. Studies included were those that compared individual exposition to air pollution between different types of active and motorized transportation. Results Of 1250 eligible titles, 18 were included and 6 were found by secondary search. The types of transportation evaluated included bicycling, walking, and using bus, mass transportation or car. Particles measured were Particulate Matter (16/24), BTEX (Benzene, Toluene, Etilbenzene, Xilene) (5), Ultrafine particles (9) and carbon monoxide (6). Evidence suggests that active transportation imply lower exposition to air pollution, compared with motorized transportation, due to proximity to sources of combustion derivates. Nevertheless, active transportation seemed to produce higher absorption of particles in airways, when adjusted by respiratory frequency, which were evaluated in 5 studies. By other hand, proximity to high-road traffic increased the exposition to particulate matter in persons who walked or used bicycle, as did transportation during the afternoon compared with at morning. Conclusion Evidence suggests that persons that use motorized transportation are most exposed to air pollution than those who practice active transportation. However, there is not enough evidence to assess the balance of risk/benefit between active transportation and exposure to air pollution, due to unmeasured attributes that modify the relation and lack of long-term evaluation.

Abstract Number	**P-1-06-10**
Presenter	Evangelia Samoli, Asimina Stamatelopoulou, Styliani Pateraki, Aikaterini Bougiatioti, Thomas Maggos, Nikolaos Mihalopoulos, Dimosthenis N. Asimakopoulos, Klea Katsouyanni*
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Fine particulate air pollution and its components in association with mortality in Athens, Greece

Background and Aims: Recent epidemiological research on the adverse health effects of particulate air pollution is focused on the ionic and carbonaceous composition of the particles in order to identify the most toxic components. We investigated the short term effects of fine particulate matter with aerodynamic diameter <1μg/m3 (PM1), and of selected components of particulate matter with aerodynamic diameter <2.5μg/m3 (PM2.5) on total, cardiovascular and respiratory mortality for all ages as well as for those above and below 75 years of age in Athens, Greece during the hot season in 2007-2009. Methods: Concentrations of PM1 and PM2.5 ionic and carbonaceouscomponents were available for 1/3/2008 – 5/8/2008 from four cites in the greater Athens area. Using prediction models we estimated the concentrations for the corresponding periods in 2007 and 2009. The associations were investigated using Poisson regression models allowing for overdispersion, controlling for seasonality, weather, day of the week, and holiday effects. Results: A 6.2 μg/m3 increase in PM1 same day levels was associated with a 2.30% increase (95% confidence interval (CI): 0.25%, 4.38%) in the number of daily deaths. Increases in two days' concentration of sulfate, ammonium, elemental and organic carbon were associated with statistically significant increases in deaths. The highest increase in mortality was associated with elemental carbon concentrations (4.77% (95%CI: 1.63%, 8.00%), for an interquartile increase). Similar results were observed for mortality among those >75 years and for cardiovascular mortality for all ages, while the effects on the younger age group did not reach statistical significance. Only elemental carbon had a statistical significant adverse association with respiratory mortality all ages. Conclusions: Our findings, though limited by the small time period analyzed and the imputation of the particles indices, indicate statistically significant health effects of elemental carbon on mortality.

Abstract Number	**P-1-06-11**
Presenter	Nadine Kubesch*, Juan R Gonzales, Mariona Bustamante, Audrey de Nazelle, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	other
Type of research	others

Gene Expression Changes in Healthy Volunteers after Exposure to Traffic Related Air Pollution and Physical Activity

Background:Gene-expression enlarges the scope of conventional health effect research to the identification of potential early health biomarkers and biological mechanisms underlying pathologic responses to air pollution exposure. Aims:This study was to determine gene-expression changes in a healthy population following traffic air pollution exposures, and potential effect modification by moderate physical activity. Methods: Well controlled crossover study comparing whole blood gene-expressions pre- and 40 minutes post exposure in healthy non-smoking subjects. Exposure was for 2 hours to contrasting pollution levels while either cycling or resting. Each volunteer was to undergo four conditions (high vs. low exposure; cycling vs. resting). Microarray expression profiles were obtained using the GeneChip PrimeView Human Gene-Expression Array (Affymetrix,CA) and the GCS3000 Affymetrix platform.Microarray data were normalized using rma method. Statistical analyses were performed using limma package; enrichment analysis using Gene Ontoloty (GO). Results: Ultrafine particles, elemental carbon, and nitric oxides levels at the high exposure site were on average 5, 7, and 10 times higher than the low exposure site, respectively. Twenty-eight volunteers completed all 4 exposure combinations (53,6% females; mean age 34,4 years). At 10% FDR cycling in low air pollution led to a deregulation of 224 genes, while cycling in high air pollution to 55 genes. No gene deregulation was found as a consequence of air pollution in either scenario (resting or cycling). Enrichment analysis for exercise in low pollution levels revealed several over-represented GO categories including lymphocyte activation, muscular activity response or muscle tissue development. Conclusions: Preliminary analysis suggests that gene-expression deregulations can be attributed to the exercise rather than to the air pollution. Ongoing statistical analysis is expected to verify findings and to inform about specific pathways.

Abstract Number	**P-1-06-12**
Presenter	Antonella Zanobetti*, Elena Austin, Brent A. Coull, Joel D. Schwartz, Petros Koutrakis
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Health Effects of Multi-pollutant Mixtures

Background: The association between exposure to particulate matter and mortality is well established; there are still uncertainties as to whether certain chemical components are more harmful than others. Moreover understanding the health effects associated with exposure to mixtures of pollutants may lead to more effective regulatory strategies. Aims: Recently we have introduced a new approach which uses cluster analysis to identify distinct air pollutant mixtures by classifying days into groups based on their pollutant concentration profiles. In Boston during the years 1999-2009, we examined whether the effect of PM2.5 mass on total mortality differed by the distinct pollution mixtures. Methods: We applied a Poisson regression time series analysis to examine the association of PM2.5 mass with daily deaths. We then included an interaction term between PM2.5 and the pollution mixture clusters. Results: We found a 1.8% increase (95% CI: 0.6-3.1) in total mortality for 10 mg/m3 increase in the two-day average concentration of PM2.5. The effect is higher in a cluster characterized by high concentrations of the elements related to traffic pollution with a 4.9% (95% CI: 0.9 - 9.0) increase in total mortality for 10 mg/m3 increase in the two-day average of PM2.5, and in a cluster which represented days highly impacted by transported regional pollution, with a 2.9% (95% CI: 0.4 – 5.4) increase in mortality for the same exposure metric. Furthermore, the other clusters represent days with a higher proportion of road dust, re-suspension of crustal particles, and combustion sources. Conclusions: Our study shows a higher effect of PM2.5 on total mortality during days with a strong contribution of traffic emissions and regional transported pollution. Our proposed method used to create the multi-pollutant profile is robust, and provides a promising tool to identify multi-pollutant mixtures which can be linked to the health effects.

Abstract Number	**P-1-06-13**
Presenter	George Downward, Hu Wei, Harry Veld, Nathaniel Rothman, Fusheng Wei, Jun Xu, Guoping Wi, David Large, Boris Reiss, Qing Lan, Roel Vermeulen*
Exposure	others
Health domains	cancer
Type of research	others

Heterogeneity in coal composition and the implications for the lung cancer risk in XuanWei and FuYuan, China

Background: Xuanwei and Fuyuan counties in Yunnan province, China have the highest lung cancer rates in China. This has been associated with the domestic use of locally sourced “smoky” (bituminous) coal. Significant geographical variation in cancer rates has also been observed, suggesting heterogeneity in fuel source composition and/or combustion characteristics. Relatively little is known as yet about heterogeneity in coal composition in the region. Limited research thus far has indicated that the coal in the region contains notably high levels of organics, notably polycyclic aromatic hydrocarbons and free crystalline silica. Methods: Coal samples were collected as part of a large cross-sectional molecular epidemiology study throughout the XuanWei and FuYuan areas. Coal samples were analysed for a variety of characteristics including: petrochemical potential, trace elements, carbon-sulphur and mineralogical components. Results: 146 samples were retrieved from participating households. Analysis revealed significant differences between smoky and smokeless coal with regard to petrochemical potential, trace elements, carbon-sulphur and mineralogy. Of note, smoky coal contained higher levels of hydrocarbons and quartz and lower levels of aluminium than smokeless coal. Further significant variation was observed for hydrocarbons and trace elements (including aluminium and silicon)on the basis the geographical source of the coal. Discussion: Our findings indicate that clear and measurable differences exist between smoky and smokeless coals sourced from Xuanwei and Fuyuan districts as well as a significant degree of heterogeneity within coal types. Decreased aluminium may indicate elevated free silica, which would be consistent with the observed higher levels of quartz. Elevated hydrocarbons would be consistent with previous observations of elevated polycyclic aromatic hydrocarbons in coals from the area. Future research is required to establish which (if any) of the observed differences translate into indoor air pollution and cancer risk.

Abstract Number	**P-1-06-14**
Presenter	Eunice Lee*, Edmund Seto, Li Nan, Hua Zhang, Yiming Zhao
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Investigating Community Exposure to Traffic-Related Particulate Matter and Noise Pollution in Beijing using Electrical Bicycle

Investigating Community Exposure to Traffic-Related Particulate Matter and Noise Pollution in Beijing using Electrical Bicycle Authors: Eunice Lee, University of California, Berkeley, USA, izeunice@gmail.com Li Nan, Peking University, China Zhang Hua, Peking University, China Yiming Zhao, Peking University, China Edmund Seto, University of California, Berkeley, USA Background: Recent articles on PM2.5 levels in Beijing highlight the need for better environmental management through broader networks of long-term air quality monitoring. Aims: We sought to explore spatial and temporal variability of air and noise pollution in the urban core of Beijing and their association with automobile traffic. Methods: We conducted a pilot study in summer 2012. For mobile monitoring, two particle monitors, noise dosimeter, and GPS were carried by researchers riding electrical bikes along pre-determined paths in two neighborhoods; Dongcheng and Haidian districts. We randomly chose point locations along each path, conducted 10-minute average measurements of particulates and sound pressure level, and assessed their correlation with simultaneously observed vehicle counts. Results: We were able to capture spatial and temporal variation of particle numbers along the roadways we conducted mobile monitoring campaigns with electrical-bikes. In comparing the performance of air monitors, we found moderate to high correlation between Dylos and Aerocet-531 particle counters in Dongcheng (Pearson's r=0.49) and Haidan (r=0.96) neighborhoods. The 10-minute average measurements of total number of vehicles and sound pressure level (Leq) were highly correlated in both neighborhoods (r=0.85 and r=0.57, Dongcheng and Haidan respectively). Conclusions: Our study demonstrated that utilizing electrical-bikes with low-cost air monitors may be an efficient method to estimate community exposure, and also emphasizes the importance of long-term and regular monitoring of air quality in Beijing. Keywords: air pollution, community noise, traffic

Abstract Number	**P-1-06-15**
Presenter	Yi Wang*, DeMarc Hickson, Annie Gjelsvik, Charles Eaton, Sharon Wyatt, Gregory A. Wellenius
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Long-term Exposure to Traffic Pollution and Subclinical Atherosclerosis in African Americans: Results from the Jackson Heart Study

Background: Long-term exposure to ambient air pollution may be associated with subclinical atherosclerosis, but few studies have evaluated long-term exposure to traffic-related pollution. Moreover, this hypothesis has not been previously evaluated in African Americans. Aims: We assessed the cross-sectional association between markers of long-term exposure to traffic pollution and carotid intima-media thickness (CIMT), a marker of subclinical atherosclerosis, in 4,995 African American adults in Jackson, MS. Methods: We calculated residential distance to the nearest major roadway and sum of road length within a radius from residence. Maximum CIMT was measured in the common carotid artery via B-mode ultrasonography. We used linear regression to estimate the percent difference in CIMT associated with residential proximity to major roadways, adjusting for age, sex, body mass index (BMI), smoking, alcohol consumption, individual- and neighborhood-level markers of socioeconomic status, residential food environment, and history of cardiovascular disease. Results: Participants were 63% female with a mean age of 54.9 (SD: ±12.8) years. CIMT was positively associated with age, sex, BMI, smoking, hypertension and hyperlipidemia. Living <50m, 50-200m, 200-400m,400-1000m (vs >1000m) from a major roadway was associated with a non-significant 3.2% (95% CI:-13.1%, 7.8%), 5.1% (-11.6%, 1.9%), 0.1% (-4.3%, 4.3%), 0.2% (-2.6%, 2.3%) decrease in CIMT after adjusting for potential confounders, respectively. No significant linear trends were observed (p=0.07). The results were not materially different when considering the log of distance to roadway as a linear continuous variable, the sum of road length as exposure or after additional adjustment for hypertension, diabetes and hyperlipidemia. Conclusions: Among African American participants in the Jackson Heart Study, we found no evidence of a cross-sectional association between markers of long-term exposure to traffic pollution and subclinical atherosclerosis as assessed by CIMT.

Abstract Number	**P-1-06-16**
Presenter	Chang Ho Yu, Zhihua (Tina) Fan*, Yingjun (John) Ma, Clarimel Cepeda, Robert Laumbach
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Mobile Monitoring Approach to Characterize Spatial and Seasonal Variation of Traffic-Related Air Pollutants in an Urban Community

A new mobile monitoring approach was conducted to characterize spatial/seasonal variations of traffic-related air pollutants (TRAP) in the 'Ironbound' community of Newark, NJ. The mobile monitoring strategy utilized real-time monitors (PM2.5 monitor, ultra-fine particle counter, black carbon monitor, CO monitor, and a GPS tracker). Based on traffic and source information, we selected 4 spatially distributed locations for sampling (5 stops each for 5 minutes) along two parallel linear paths moving away from major roadways and/or along more heavily-trafficked roads in the community. Two concurrent sampling (distant one block each other) was conducted by two staffs carrying the monitors and walking through the predetermined route for ~ 2 hours in the morning in 7 separate days in March/April and 6 days in May/June, 2012. The 5-minute averaged BC concentrations (AVG±SD, [range]) were 2.61±2.88 [0.09 – 34.4] µg/m3, particle counts were 33,330±23,451 [2,512-159,130] #/m3, PM2.5 mass concentrations were 9.24±9.68 [0.27-115.76] µg/m3 and CO concentrations were 1.63±0.84 [0.22-6.89] ppm, respectively. All the four TRAP concentrations were significantly associated each other ($p<0.05$), but different spatial patterns by each type. Exponential decreases were observed for areas impacted by heavy-trafficked highways; otherwise, no spatial differences were observed for the locations due to those locations were also impacted by nearby local roadways. Seasonal differences were observed higher in cold days than in warm days. GIS-provided covariates and meteorological variables will be collected and tested using a multiple linear regression model for each TRAP. The final regression model will be validated with comparison with reference sites data and will be mapped for the study area by ArcGIS program. The study demonstrates the mobile monitoring approach and its implication is relevant for capturing spatial characteristics in an urban community with high traffic sources nearby.

Abstract Number	**P-1-06-17**
Presenter	Halûk Ozkaynak*, Kathie Dionisio, Lisa Baxter, Janet Burke, David Q Rich, Stefanie Sarnat, Jeremy Sarnat, Rena Jones
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

Overview and Evaluation of Alternative Air Quality Exposure Metrics Used in Recent Air Pollution Epidemiological Studies

Background: Epidemiological studies of air pollution have traditionally relied upon surrogates of personal exposures, such as ambient concentration measurements from central-site monitoring stations. However, this approach may introduce exposure prediction errors and misclassification of exposures for certain spatially heterogeneous pollutants, such as those associated with traffic emissions. We review alternative air quality and human exposure metrics applied in recent air pollution health effects studies in the United States. Exposure metrics for particulate and gaseous pollutants are evaluated in the context of different epidemiological studies recently conducted in the U.S by EPA, Rutgers/Rochester/LBNL, Emory/Georgia Tech and New York State Department of Health and North Carolina State University. Methods: Alternative exposure metrics considered are: central site or interpolated monitoring data, regional pollution levels based on measurements or models (CMAQ) and local scale (AERMOD) air quality models, hybrid models, statistically blended modeling and measurement data, infiltration adjusted concentrations and the population human exposure (SHEDS and APEX) model predictions. Health data sets used, include: daily mortality and respiratory hospital admissions in New York City, daily hospital emergency department visits in Atlanta, daily myocardial infarctions and adverse birth outcomes in New Jersey. Exposure and epidemiological applications of alternative exposure metrics are compared across the different study areas. Results: Findings show both pollutant and metric specific differences in predicted relative risks for local and regional ambient pollutants, in particular, effect modification by air exchange and infiltration rate estimates or time spent outdoors/commuting. Application-specific study design choices and enhancements to air quality exposure indicators for future air pollution health studies are highly recommended.

Abstract Number	**P-1-06-18**
Presenter	Johan Nilsson Sommar*, Alexandra Ek, Roelinde Middelveld, Helén Bertilsson, Anders Bjerg, Linda Ekerljung, Andrei Malinovschi, Pär Stjärne, Sven-Erik Dahlén, Christer Janson, Bertil Forsberg
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Quality of life in relation to the traffic pollution indicators NO2 and NOx: results from the Swedish GA2LEN Survey

Background Asthma is a chronic disease that may affect daily activities and quality of life. It is known that asthmatics have a higher incidence of chronic rhinosinusitis (CRS), and that asthma is associated with sinonasal inflammation and nasal symptoms, that all impair quality of life. Worsening of asthma has been found associated with nitrogen oxides as traffic indicators. Aims The aim of the study was to evaluate the impact of nitrogen oxides (NO2 and NOX) on quality of life in asthmatic subjects, individuals with CRS, and controls. Methods Within the Swedish Ga2len (Global Allergy and Asthma European Network), 605 asthmatics with and without CRS, 110 individuals with CRS only and 226 controls were surveyed. The mini Asthma Quality of life Questionnaire (mAQLQ), the Euro Quality of Life (EQ-5D) health questionnaire, spirometry, skin prick test, exhaled nitric oxide, smell test and peak nasal inspiratory flow were used. Air pollution levels at the home address were modeled using dispersion models. Results Levels of NO2 (median 10 µg/m3, interquartile range 7.5-15) and NOx (13 µg/m3, 8.7-70) were similar among conditions (controls, asthmatics, individuals with CRS, and asthmatics with CRS). The mAQLQ overall score was not found associated with levels of NO2 or NOx, with or without adjustments, and neither were scores within each of the four domains of mAQLQ: symptoms, activity limitations, emotional functions, and effects of environmental stimuli. The mean EQ-5D index value, based on the five dimensions mobility, self-care, usual activities, pain/discomfort and anxiety depression, was also found unrelated to NO2 and NOx. Stratification by condition did not reveal any differences in NO2 or NOx related effects. Conclusions Within these moderate exposure levels, NO2 and NOx appear not to affect quality of life among controls, asthmatics, individuals with CRS, or asthmatics with CRS. This could perhaps be explained by selection bias related to susceptibility (avoidance) or confounders related to the type of residential area.

Abstract Number	**P-1-06-19**
Presenter	Ioar Rivas*, Jordi Sunyer, Teresa Moreno, Mar Viana, Mar Álvarez Pedrerol, Andrés Alastuey, Xavier Querol
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

School traffic air pollution in the BREATHE Project

Background: Health problems derived from the exposure to particulate matter (PM) is a research field of major interest. School children constitute a high vulnerable group to environmental threats. Exposure to outdoor particles is a common input in epidemiological studies. However, children spend most of their time indoors and, therefore, exposure to indoor PM has to be assessed. Aims: The BREATHE project evaluates whether traffic-related air pollutants (TRAPs) may impair brain development of school children in the city of Barcelona. The aim is to describe the air pollution at school level. Methods:TRAPs were continuously measured in 39 schools during two campaigns of one week periods, including real time levels of black carbon, PM2.5, ultrafine particles counts, and particle surface area; 8-h averages of PM2.5 mass and 45 PM2.5 components (including elemental and organic carbon, soluble ions and, metals) during class time; and weekly NO2. All these parameters were simultaneously measured within a classroom, in the school playground, and in one urban background (UB) air monitoring station at Barcelona for seasonal adjustment. Two paired schools based on socioeconomic conditions were evaluated every week. Results: Schools showed high levels of air pollutants (particularly PM2.5) and a large within city variability.Results evidenced that PM2.5 levels (both indoors and outdoors) were highly influenced by school activities. Outdoor PM2.5 levels are more than double the usual UB levels reported for Barcelona. Also outdoor TRAP levels were higher than UB levels, but with a factor between 1.2-1.6. Source contribution to indoor and outdoor environments were quantified and showed and important indoor source (mainly OC). The presence of sand playgrounds has also a major role in PM2.5 levels in schools. Conclusions: PM2.5 levels at schools were not an indicator of traffic but of school activities and playground characteristics. TRAPs levels found outdoors in schools are not equivalent to those measured in UB but intermediate between this environment and traffic sites.

Abstract Number	**P-1-06-20**
Presenter	Andreas M. Neophytou*, Jaime E. Hart, Yan Chang, Junfeng Zhang, Thomas J. Smith, Eric Garshick, Francine Laden
Exposure	ambient air pollution
Health domains	other
Type of research	occupational study

Short-term personal traffic-related exposures and biomarkers of nitro-PAH exposure and oxidative DNA damage

Background: Traffic attributed exposures including diesel exhaust exposures have been associated with cardiac-related health outcomes, respiratory disease, lung cancer, and overall mortality. However, few biomarker indicators of exposure have been identified. Nitro-polycyclic aromatic hydrocarbons (nitro-PAHs) have been considered as diesel exhaust specific compounds. Their metabolites, amino-PAHs, may be used as biomarkers of diesel exhaust exposure. Aim: Assess relationships between urinary amino-PAHs and vehicle exhaust exposures to examine their efficacy as biomarkers of internal dose, and relationships with oxidative DNA damage. Methods: Urine samples were collected pre- and post-shift, at the beginning and end of a work week from 95 male U.S trucking industry workers. We used repeated-measures analysis to assess total 1- and 2-aminonaphthalene (1-AN & 2-AN) and 1-aminopyrene (1-AP) urinary concentrations with concurrent microenvironment particulate matter (PM-2.5), elemental and organic carbon (EC & OC), and urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG). Results: There was a suggestive association between daily PM2.5 ---levels and post-shift urinary 1 & 2-AN levels with a 115.0 pg/ml increase (95% CI:-0.5, 230.1) associated with every IQR increase in PM-2.5, but there were no other associations with daily or mean PM-2.5, EC, or OC . There were significant associations between pre-shift levels of 1 & 2-AN and post-shift 8-OHdG levels and between concurrent 1-AP and 8-OHdG levels with 4.64 (95% CI: 0.81, 8.45) and 3.29 (95% CI: 0.05, 6.59) µg/g urine creatinine increases in 8-OHdG levels per IQR increase in exposure biomarkers, respectively. Conclusions: Our findings suggest only weak associations of the urinary amino-PAHs with PM2.5 in this trucking industry population. However, amino-PAHs were significantly associated with 8-OHdG, suggesting that the internal dose markers may be more relevant to oxidative DNA damage than external measures of vehicular exhaust.

Abstract Number	**P-1-06-21**
Presenter	David O. Nelson*, Erika Garcia, Susan Hurley, Peggy Reynolds
Exposure	ambient air pollution
Health domains	cancer
Type of research	others

Using risk to guide dimension reduction with complex pollution data

Background: In air pollution studies, epidemiologists are often faced with the dilemma of having to analyze the concurrent effect of many correlated pollutants on the risk of a health outcome. Common methods for dealing with this situation break the problem into two parts: first, focus solely on exploiting the correlation structure among pollutants, and second, use the results of these preliminary analyses as inputs to quantifying the risk. Aims: The objective was to assess the extent to which incorporating information about the outcome of interest (breast cancer) directly into the dimension-reduction process would produce a more effective summary of the relationship between breast cancer risk and a large number of highly correlated pollution exposure estimates. Methods: The population at risk consisted of 112,380 members of the California Teachers Study who, at baseline, had no prior history of breast cancer and lived at a geocodable California address. 5,025 cases of invasive breast cancer were subsequently diagnosed 1996-2009. Estimated levels of HAPs were obtained from the U.S. EPA's 2002 NATA database and assigned to study participants' baseline addresses based on census tract. Risk-independent methods included PCA, multivariate graphical models, and various clustering and MDS approaches. Risk-dependent methods included sparse network methods, machine-learning approaches, and graphical models augmented with outcome information. Results: Both approaches produced visually compelling images of the relationships among these pollutants, highlighting clusters of dependent pollutants as well as confounding between pollutants. However, the two approaches often produced considerably different pollutant summaries. Conclusions: Incorporating risk directly into the summary process provides a complementary way to characterize multidimensional, highly correlated pollutant data which, when used appropriately, can also directly address the risk relationships of interest.

Abstract Number	**P-1-06-22**
Presenter	Cambal Leah*, Emily Elliott, J. David Felix, Brett Tunno, Jane Clougherty
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Using the Nitrogen Isotopic Composition of NO2 (?15N-NO2) for Source Apportionment in an Urban Area

Introduction: Nitrogen oxides (NOx), produced from combustion sources and natural processes, are ozone precursors and respiratory irritants. Recent studies document distinct source-specific isotopic compositions in NO2 (δ15N-NO2). Despite source signatures which isotopic composition may provide, few studies have used isotopes to distinguish multiple pollution source contributions within an urban area. Methods: Ogawa passive samplers collected NO2 for 2 week periods at 73 locations throughout Pittsburgh, PA, January-March 2013. Sites were selected using stratified random sampling, capturing variability in hypothesized key NO2 sources in our region (e.g., traffic density, proximity to industry, elevation, bus route frequency density). For isotopic analysis, denitrifying bacteria, Pseudomonas aureofaciens, is used to convert sample NO2- into gaseous N2O. The N2O is analyzed using a trace gas and autosampler coupled with a continuous flow isotope ratio mass spectrometer. Spatial patterns in δ15N-NO2, and relationships with source density, will be explored using GIS based covariates. Land use regression modeling methods will be explored, to explain spatial variability in isotope signatures. Results: A pilot study revealed wide variability in δ15N-NO2 across the Pittsburgh region [μ = -0.66 0/00 (range= -7.75 to +7.37 0/00)], supporting the utility of isotopic signatures in quantifying urban source contributions, and possible improvement of source apportionments. We are currently extending this dataset to include sampling sites across 500 km2, including 36 sites in downtown Pittsburgh, and will explore associations with local air pollution sources. Conclusions: Few studies have used isotopic signatures for source apportionment in urban areas. Significant variation in δ15N values may support quantification of urban source contributions, thus improving upon existing methods for intra-urban source apportionment.

Abstract Number	**P-1-06-23**
Presenter	Katherine Gass, Mitch Klein, Howard Chang, Stefanie Sarnat*, W. Dana Flander, Matthew Strickland
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Utilizing Regression Trees to Identify Complex Patterns of Multipollutant Joint Effects

Background: Of interest in multipollutant research are the joint effects of two or more pollutants on a given outcome. Classification and regression trees are nonparametric approaches that use supervised recursive partitioning to split data into groups that contain similar responses for the outcome. Aims: Estimate the joint effects of ambient CO, NO2, O3, and PM2.5 concentrations on respiratory emergency department visits in Atlanta, Georgia during 1998-2009. Methods: Pollutant concentrations on each day (N=4,139) were categorized into quartiles. Days when all four pollutants were in their lowest quartile (N=155) served as the referent; the remaining 3,984 days were analyzed using regression tree methods. To do this, we specified a Poisson time-series model containing terms for suspected confounders (e.g., time, meteorology) to evaluate the effect of each pollutant parameterized as a dichotomous variable according to quartile cut points (e.g., comparing quartile 1 with quartiles 2-4). The process was repeated for each pollutant across the three possible quartile cut points. The pollutant-specific cut point that resulted in the smallest p-value below a pre-specified alpha was selected as the first splitting variable, and the process was repeated on the resulting subsets of data. This continued until no cut points had a p-value below alpha (resulting in a “terminal node” in the tree). We used the time-series model to estimate the risk ratio (RR) of respiratory ED visits for each terminal node, using the subset of days when all pollutants were in their lowest quartile as the referent. Results: The regression tree is depicted for various levels of alpha. The largest RR was observed for the terminal node corresponding to days when both CO and PM2.5 were in the highest quartile (RR: 1.02, 95% CI: 1.00–1.05). Conclusions: Regression trees can be used to estimate joint effects from the data and can be used to generate hypotheses about the health effects of multiple pollutants.

Abstract Number	**P-1-08-01**
Presenter	Yuri Bruinen de Bruin*, Stylianos Kephalopoulos, Eva Csobod, Ellen Koudijs, Eduardo de Oliveira Fernandes
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

A cost-benefit mechanism available for national and local authorities to manage indoor environments in schools

Aims The mechanism aims to support prioritization of possible remedial measures based on costs and expected health gains and is available for national and local authorities, builders, school staff, pupils and parents to improve indoor air quality in schools. Methods In 25 European countries, the indoor air quality in schools and childcare settings and respective international (WHO) and national IAQ guidelines and (policy) measures were reviewed. Based on communalities and differences, prioritization criteria were set up and implemented into a cost-benefit mechanism. Results In total, four prioritization criteria were defined to categorize possible remedial measures on the basis of costs and benefits. By describing the effectiveness, proportionality, practicality and monitorability, possible measures were categorized into five groups: 1) Hygiene, 2) Awareness rising, 3) Use of products/materials, 4) Technical intervention and 5) Monitoring IAQ. Possible measures, like, cleaning practices, ventilation, avoidance of the use of certain building materials or installation of a CO2 monitor were qualitative exemplified in tabular format. Conclusions The scope, level of detail and degree of implementation of IAQ measures differ among countries. Some measures are mandatory while others are recommendations. The current mechanism supports authorities and school stakeholders to improve indoor school environments by developing best-fitting strategies accustomed to national and local situations. It is recommended that the European Commission develops harmonized international guidelines on indoor school environments. Acknowledgement This document was produced under the SINPHONIE project, which is financed by the Directorate General for Health and Consumers of the European Commission (October 2010- November 2012). Contract reference is SANCO/2009/C4/04. Project website:http://www.sinphonie.eu.

Abstract Number	**P-1-08-02**
Presenter	The Wint Aung*, Julian D. Marshall, T Pradeep, S Narayanswami, Grishma Jain, Karthik Sethuraman, Andy Grieshop, Jill Baumgartner, Conor Reynolds, Michael Brauer
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	randomized trial

Air Quality and Health Evaluation of a Climate Financed Cookstove Intervention in Rural India

Background Approximately 2.7 million people worldwide use biomass for cooking and heating. Much of this fuel is burned inefficiently in basic and poorly-vented cook stoves contributing to 3.5 million premature deaths annually, with additional impacts to climate. An Indian organization, Samuha, plans to distribute "improved" biomass cookstoves in 21,500 households as part of a climate-funded, Clean Development Mechanism (CDM), stove project. Aims Evaluate impacts of the CDM intervention on health- and climate-relevant emissions, concentrations, and blood pressure. Methods We implemented a one-year randomized controlled trial for 187 CDM-eligible households in a village in Karnataka, India, during 2011-2012. Pre- and post-intervention measurements included gravimetric fine particles (PM2.5) in all homes; real-time PM2.5, black carbon, carbon monoxide, and carbon dioxide measured in 31 homes and outdoors; and blood pressure for 221 women. Results In the intervention group (N=96 households), 52% used new stoves, 30% used a combination of traditional and new stoves, and 13% rejected the new stoves. Statistically significant increases in indoor (mean [sd] increase of: 222 [504] in control homes, 147 [573] ug/m3 in intervention homes), and ambient (17 [28] ug/m3) PM2.5 concentrations were observed between pre- and post-intervention periods. The concentration change over time was not significantly different between control and intervention groups. There was no statistically significant reduction in blood pressure in the intervention group. Conclusions We did not find significant improvement in household air pollution or blood pressure, despite laboratory tests of increased stove combustion efficiency. This finding underscores the importance of field testing stove technologies. Variability in local conditions, including users' behavior and acceptance of intervention needs to be taken into account as stove interventions increase worldwide.

Abstract Number	**P-1-08-03**
Presenter	Eusébio Conceição*, João M. M. Gomes, Tiago A. C. Machado
Exposure	household air pollution
Health domains	other
Type of research	occupational study

Air Quality and Thermal Comfort in Complex Topology Buildings

The internal air quality and the thermal comfort levels change in function to the occupation level and the external thermal conditions. In order to evaluate these levels a numerical methodology, based in uncomfortable hours, is developed and used. This methodology considers the number of hours that the PMV index and the carbon dioxide level exceeds the acceptable limits. The air quality and the thermal comfort in an academic library located in the Algarve region, with complex topology, are evaluated in this paper. The study, made in real conditions, was made during a complete year. Numerical software, that simulates the building thermal behaviour with complex topology, in transient conditions, is developed and used in the study of an academic library thermal response, the internal air quality and the occupants' thermal comfort evaluation. The modern library, localized in the South of Portugal, in a climate with Mediterranean conditions, has 134 compartments, 1578 opaque building main bodies and 307 windows with simple transparent glass. In the numerical simulation the external meteorological data, namely the air velocity, air temperature, air relative humidity, wind direction, occupation cycle, occupants' clothing and occupants' activity levels and ventilation topology are considered as input data. The results of the building air quality and thermal comfort levels, as well the air quality uncomfortable hours and the warm and cold thermal comfort uncomfortable hours, that the occupants are during a complete year, are obtained. In this paper is also obtained the air exchange rate that minimize the percentage of dissastified people simultaneously for indoor air quality and thermal comfort, during a complete year.

Abstract Number	**P-1-08-04**
Presenter	Arto Pennanen*, Arja Asikainen, Tapani Tuomi, Sinikka Vainiotalo, Arto Säämänen, Raimo O Salonen
Exposure	organic compounds
Health domains	healthrelated quality of life
Type of research	exposure measurement

Artificial turf as a source of harmful compounds in indoor air of sports arenas

Background Artificial turf fields, cushioned with rubber granulates for outdoor or indoor football, have raised health concerns in many countries. Styrene butadiene rubber (SBR) granulates made from recycled vehicle tires are widely used also among the one hundred indoor football arenas in Finland. Aims The aim was to investigate the chemical composition (VOC, PAH, metals) of the rubber granulates, the levels of air pollutants, and nuisance and health detriments among adolescent arena users in five indoor arenas. Methods Three permanent arenas (73000-132000 m3) and two pressurized canvas domes (35000-65000 m3) were studied during daily activity in the end of winter season. VOC, PAH, and particulate samples were collected from indoor air along with continuous monitoring of thoracic particles (PM10). VOC emission and PAH content were analyzed from rubber granulates vacuum-sampled from the field surface. The performance of arena ventilation was investigated using air flow, temperature, and CO2 measurements, and smoke test. Results The total PAH contents of three SBR granulate samples were clearly higher (38-65 mg/kg) than those of two other types of rubber granulates (0.1 and 2 mg/kg). The indoor air PAH concentrations were negligible. Total indoor air VOCs were high in one arena (440 µg/m3). Some compounds (benzothiazole, aldehydes) were frequently found in both the SBR-rubber and indoor air. The PM10 concentrations (10-20 µg/m3) in arenas were comparable to urban outdoor levels, but inside two arenas they were about twice as high as outside. As many as 49 adolescent football players out of 90 (54%) reported at least one symptom or nuisance (dusty air, sore throat, running nose, odd smell, eye or skin irritation) during or after training in winter season. Conclusions There were large differences in VOC emissions and in PAH content between different types of rubber granulates. The indoor air of all five arenas was reported to cause symptoms.

Abstract Number	**P-1-08-05**
Presenter	Prabjit Barn*, Nathalie Gosselin, Michèle Bouchard, Tom Kosatsky
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Carbon monoxide exposures in vulnerable groups: Use of a toxicokinetic model to evaluate current indoor air guidelines and standards

BACKGROUND: Carbon monoxide (CO) is a common indoor air pollutant. CO binds to haemoglobin (Hb) to form carboxyhemoglobin (COHb), thereby reducing blood oxygen (O2). Health Canada (HC) and World Health Organization (WHO) use 2% COHb to establish indoor air guidelines, the lowest level at which a health outcome has been found (i.e. exercise induced dyspnoea in subjects with cardiovascular disease). CO effects on other physiologic vulnerabilities are not well known, including those in persons with respiratory disease (possibly higher CO uptake due to air trapping), anaemia (higher endogenous CO production and lower Hb) and elderly (reduced capacity to respond to lower blood O2). AIM: To use a validated toxicokinetic model to predict COHb in vulnerable groups (persons with respiratory disease, anaemia, elderly) resulting from exposure scenarios corresponding to indoor air guidelines and standards. METHODS: We reviewed experimental studies investigating CO exposure and COHb in healthy and vulnerable groups. Levels were compared with simulated COHb based on exposure history and parameters specific to each group, and exposure scenarios corresponding to HC and WHO guidelines. Finally, we assessed CO levels required to reach COHb associated with known health outcomes in vulnerable groups. RESULTS: We identified 2 studies for persons with respiratory disease (COPD), 1 for anaemics, and 1 for healthy elderly. Modelled COHb for all exposure scenarios were comparable for cardiac, healthy and elderly persons. Exposures corresponding to HC and WHO guidelines led to COHb levels >2% in anaemics for all scenarios and in COPD subjects for longer exposures (i.e. 24 hrs). CONCLUSION: Our findings suggest that existing guidelines may not be protective of all vulnerable groups, particularly chronically exposed COPD patients and anaemics. More research is needed to better understand CO effects in vulnerable groups. .

Abstract Number	**P-1-08-06**
Presenter	In-Keun Shim*, Wooseok Lee, Suran Won, Jinseob Kim
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Characteristics and affecting factors on indoor particulate matters in public facilities, Korea

Particulate matters with aerodynamic diameters less than 2.5 μm (PM2.5) have been found associated with increasing respiratory illness, carcinogen, asthma, visibility degradation and finally in increasing the number of premature deaths. The current acts and laws in Korea are focused on only PM10 in indoor environments. In this study, we had surveyed the status of PM10 and PM2.5 in public facilities. The target 68 public facilities are randomly selected and divided into 12 subgroups - subway platform, large-scale store, indoor parking lot, exhibition building, personal computer game providing enterprise(PC room), library and museum, child-care center, medical center, airport, railroad platform, port, bus terminal. We analyzed the mass concentration, 8 kind of ions, 21 kind of metals, 2 kind of carbons(organic carbon(OC) and elemental carbon(EC)) in particulate matters, and temperature and humidity. To find out the indoor source and the effect by outdoor air, the particulate matters had been collected in outside of buildings simultaneously. As a result of mass analysis, the mean concentration of PM2.5 and PM10 in indoor air were 29.2 μg/m3 and 41.1 μg/m3, respectively. From the indoor/outdoor ratio of PM2.5 mass concentrations in PC rooms, indoor parking lot, subway platform, port, and bus terminal were above 1.0. As a result of elemental analysis, the major element in PM was revealed carbonaceous and specifically the PC room showed the highest proportion of OC contents due to the heavy smoking in indoor environment. The metal concentration of PM2.5 in subway stations shows the highest among the studied public facilities. Especially, Fe element was a dominant element in PM2.5 in subway station due to the wearing process of steel products used in subway station such as train wheel, rail, brake, and so on.

Abstract Number	**P-1-08-07**
Presenter	Sandrine Charrier, Alexis Huet, Joris Biaunier, Myriam Olivier, Gaelle Guyot*
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	others

CONTROL OF AIRTIGHTNESS QUALITY MANAGEMENT SCHEME IN FRANCE: RESULTS AND LESSONS

Since January 1st 2013 on, the French energy performance (EP) regulation compels building airtightness level to be justified and lower than required values. Because these requirements represent an important change in the airtightness market, it is the government's responsibility to accompany this market evolution and to supervise the quality of building airtightness implementation. French regulation allows two ways to justify the envelope airtightness value. Either the constructor performs a systematic measurement on each building, or the constructor proves it implements a validated quality management approach. In order to evaluate the airtightness quality management schemes, a specific national committee has been launched by the French government. It aims at authorizing constructors to justify their buildings airtightness level through a quality management scheme. The CETE de Lyon is in charge of this committee. In this framework, each validated constructor must send a yearly specific file to the committee, so as to prove the actual and yearlong application of his approach. In addition, the committee started a first control campaign in 2011. This campaign, realized by civil servants, aimed at: - Verifying the implementation effectiveness of quality management approach, on some buildings selected by the committee - realizing airtightness tests on some buildings, chosen by the committee. This paper will present a synthesis of the results and the lessons learnt from this first control campaign. The main results are that on the one hand all measurements comply with required values, but on the other hand, the quality management scheme is not usually entirely implemented by the constructor. The paper concludes on the enlargement yet possible in the quality management scheme: ventilation system and duct airtightness. Indeed energy efficiency, important target, should not be separated from indoor air quality, and both performances can now be associated into a sole quality management approach.

Abstract Number	**P-1-08-08**
Presenter	Ying Xu*, Yirui Liang
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	others

Emissions of Phthalate Plasticizers from Vinyl Flooring: The Impact of Temperature, Ventilation and Surface Sorption

The emission rates of di-2-ethylhexyl phthalate (DEHP), di-butyl phthalate (DBP) and di-isononyl phthalate (DINP) from different vinyl floorings were measured in a specially-designed stainless steel chamber. The chamber maximized the surface area of the source, minimized the surface area of the sink (the interior surface of the chamber and sampling pathway) ,thereby reducing the time to reach steady-state, and could directly measure the sorbed surface concentration. Emission tests were conducted under different temperatures (20-60oC) and flow rates (500-2000 mL/min). At steady state, phthalate concentrations in the chamber increased 200-fold when temperature increased from 20 °C to 60 °C. The time to reach steady state and the adsorption effect decreased significantly with temperature increase. It indicated that temperature has a strong influence on phthalate emissions. With the increase of airflow rates, the time to reach steady state increased and the steady state gas-phase concentration decreased. To investigate the impact of surface sorption, in addition to stainless steel, glass and hard wood were also employed as materials of chamber construction. The gas-phase concentration in all chambers increased slowly and reached to a similar steady state concentration. However, the time to reach steady state is quite different, which is most likely due to the difference in adsorption levels on each type of chamber material.

Abstract Number	**P-1-08-09**
Presenter	Lucy McCann*, Rebecca Close, Les Staines, Graham Cutter, Giovanni Leonardi
Exposure	household air pollution
Health domains	no health domain
Type of research	cross-sectional study

Establishing the burden of Carbon monoxide exposure in private homes

Background: Exposure to CO in private homes can cause CO poisoning, but the extent of the problem is largely unquantified, with little reliable evidence. The burden of CO poisoning is likely to be underestimated due to presentation of non-specific health symptoms. Hackney Homes (HH) began fitting CO alarms in the 23,000 local authority homes they are responsible for, in January 2010. Aim: To carry out a community survey to provide a more accurate picture of potential exposure to carbon monoxide and associated interventions in an inner-city community. Methods: We undertook a descriptive study using data from the Gas Safe forms recorded by HH when an alarm is activated. Data captured included: source and concentration of CO indoor, interventions by HH (telephone call, visit by a gas engineer). Results: Initial results show that of the 42 incidents reported to HH between January and July 2010, 74% identified the cooker, boiler or both in operation at the time of the incident. For 26% of incidents, the cooker was found to be faulty or in need of a service; in a further 26% of cases, misuse of appliances by the tenant was found (e.g. placing foil around the hob); relevant advice was provided. Analysis of all incidents occurring between January 2010 and March 2012 is ongoing. Discussion: Little is known about the burden of CO poisoning in private dwellings, which this study will go some way to addressing, as well as identifying whether there is a need for more detailed future studies.

Abstract Number	**P-1-08-10**
Presenter	Nishanthini Vijayakumar shakila*, Nishanthini Vijayakumar shakila, Krista Parker, Glenn Morrison
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Freebase methamphetamine accumulation in clothing and skin oil

Methamphetamine (meth) is a drug of abuse in the United States and it is frequently produced in residential “meth labs”. Even after remediation, meth and other chemicals can be released into occupied spaces and accumulate in clothing and toys. The presence of skin oil on these materials could result in surface concentrations of meth greater than proposed health-based standards. Our aim was to determine the equilibrium partitioning of vapor-phase meth with different materials over a 60 day period. We measured the dynamic surface accumulation of meth exposed to vapor at 38ppb using a flow through chamber. The materials were exposed for 3, 6, 15, 30 and 60 days. Teflon filters coated with skin oil from volunteers were exposed to determine the meth accumulation in skin oil. The experiment was conducted at 25oC and at a relative humidity of 30% and then again at 60%. The average meth accumulation in units of µg of meth per gram of sample per ppb at 30% RH and 60 days of exposure was 2.96±0.15 in a baby blanket, 5.55±3.53 in a baby book, 3.71±0.15 in polyester nightwear,18.3±8.01 in upholstery fabric and 1203±569 in skin oil. The accumulation at 60% RH was 4.50±0.40, 5.19±2.10, 4.48±0.59, 36.1±3.57 and 1617±1146 respectively. At 60 days of exposure it appears that the accumulation of meth in all of the materials is approaching equilibrium except for the upholstery fabric and skin oil. The concentration of meth in upholstery fabric increases notably through day 60. There are significant differences in the measured concentration of the meth in the skin oil throughout both experiments that could be due to the variable composition of skin oil in humans. The accumulation of meth in skin oil is three orders of magnitude greater when compared to its accumulation in other materials and greatly exceeds proposed health based standards for remediated surfaces.

Abstract Number	**P-1-08-11**
Presenter	Sangchom Siripanich*, Wattasit Siriwong, Mark Gregory Robson
Exposure	household air pollution
Health domains	respiratory disease
Type of research	occupational study

HAZARDOUS IDENTIFICATION AND HEALTH RISK ASSESSMENT RELATED TO INCENSE AND JOSS STICK MAKING IN SMALL HOUSEHOLD FACTORIES,

Background: Incenses and joss sticks are generally used in the world and most products from China,Taiwan,Vietnam, ndia, and Thailand. The most incense and joss sticks have been making from the northeast of Thailand.The factories are operated by manually in household and around villages. Aims: The aims of the studywere to identify hazards and health risk from the process of incense and joss stick making in small household factories. Methods:The walkthrough survey study was conducted in October 2011-March 2012,Roi-Et,Thailand.The real time exposure monitoring by measuring aerosol and particle concentration was completed using Dust-trakPmmonitor. The ICP-OES method was used for heavy metal residue analysis. Atomic Absorption Spectrophotometry method for BLL. Results: Nine small household factories and 51 workers were selected for the study. Only 3.9 % used PPE during working. Several heavy metal concentration were found in incense stick products such as Mn, Pb, Ni, Cd were 1.45±0.03 (mg/kg), 0.95±0.03 (mg/kg),0.84±0.09 (mg/kg),0.15 ±0.01(mg/kg),respectively.The dust concentration and particles count measurement showed that was high in the step of rolling and shaking with fine powder (1.12 mg/m3,7730.3), rolling and shaking with coarse wood powder (0.68 mg/m3,1508.3)and packing.(0.27 mg/m3, 8890.2). An average mean difference of BLL testing in incense workers and non - incense workers were 4.719±1.69 µ/dl and 3.535±1.05 µ/dl.(p-value <0.001). Conclusion: Dust and chemicals used in incense and joss stick making were major threats and contaminated in household. The health effects resulting from the process of incense making, such as respiratory diseases, skin diseases, injuries and ergonomics. Workers should be awareness to health protection by using PPE during working and emphasis on environmental workplace management is important to perform consistently. Key word: incense and joss stick, household factories, hazardous Identification, health risk assessment

Abstract Number	**P-1-08-12**
Presenter	Kuo-Pin Yu*, Ke-Ruo Yang, Shih-Chun Candice Lung, Chun-Hu Liu
Exposure	household air pollution
Health domains	cancer
Type of research	health impact assessment

Health risk assessment for inhalation exposure to particle-bound polycyclic aromatic hydrocarbons from household cooking in northern Taiwan

Background: Food cooking generates lots of harmful fine and ultrafine particles.Many occupational studies have shown that the incremental lifetime cancer risk (ILCR) caused by exposure to polycyclic aromatic hydrocarbons (PAHs) in cooking fume was much higher than the suggested acceptable limit of 10-6. However, the higher exposure level of occupational studies cannot represent the exposure of the general population. Aim: To assess the health risk for the exposure to cooking fume of daily household cooking, since these data may be more representative and is currently limited in Taiwan Method: We took particle and gaseous PAHs samples using a Micro-Orifice Uniform-Deposit Impactors and glass cartridge packed with Amberlite XAD-16 polymeric adsorbent, respectively, during cooking periods from five families without smoker in northern Taiwan. These samples were extracted and then analyzed by theGC/MS. The ILCR caused by exposure tocooking fumewas evaluated based on PAHs analysis result.We also monitored the 24-hour particle concentrations profile by using a Scanning Mobility Particle Sizer and a 6-channel optical particle counter. Result: Although gaseous PAHs contributed more than 85% of the total PAHs, particulate PAHs percentage increased with ring number of PAHs and contributed the most of banzo[a]pyrene equivalent concentration (B[a]Peq). The B[a]Peq is significantly positive correlated with the mass of larger particles (>3.2 µm) but negative correlated with that of particles smaller than 0.056µm, indicating that most toxic PAHs deposited on larger particles. The ILCR caused by household cooking fume is lower than those reported in occupational studies. However, the ILCR is higher than10-5, implying that even the exposure to PAHs from daily household cooking could result in a significant cancer risk. Conclusion: Most toxic PAHs of household cooking fume deposited on large particles and caused a considerable cancer risk in northern Taiwan.

Abstract Number	**P-1-08-13**
Presenter	Halûk Ozkaynak*, Kristin Isaacs, Jianping Xue, Rocky Goldsmith, Peter Egeghy, Daniel Vallero, John Wambaugh
Exposure	household air pollution
Health domains	other
Type of research	exposure modeling

High Throughput Exposure Prioritization of Chemicals Using a Screening-Level Probabilistic SHEDS-Lite Exposure Model

Background: EPA's National Exposure Research Laboratory, in collaboration with its National Center for Computational Toxicology, is developing a strategy for high-throughput exposure-based prioritization of chemicals under the ExpoCast program. These novel modeling approaches for screening, evaluating and classifying chemicals based on the potential for biologically-relevant human exposures will inform toxicity testing and prioritization for chemical risk assessment. Methods: The new modeling approach is derived from the Stochastic Human Exposure and Dose-Simulation Model (SHEDS) for multimedia pollutants. To accommodate high-throughput chemical assessments, SHEDS has been numerically and operationally reduced to a “Lite” form that reduces user burden and increases run speed. Initially, the SHEDS-Lite model has been applied to chemicals associated with consumer products used in homes. Model input data for these evaluations come from recent NERL/NCCT efforts to characterize usage (prevalence, frequency, and magnitude), chemical composition, and exposure scenarios for a wide range of consumer products. Near-field indirect scenarios uses a fugacity-based source-to-concentration module to estimate indoor concentrations by media (air, dust, and surfaces), while near-field direct scenarios are addressed via appropriate exposure equations. The concentration estimates, relevant exposure factors, exposure predictions, and human activity data are then used by the model to rapidly generate population distributions of potential exposures via dermal, non-dietary ingestion, and inhalation pathways. Results: Population dietary exposures for chemicals expected in foods is being produced by a dietary module linked to the residential module to produce total population exposure estimates. Preliminary exposure results obtained from applying this rapid computational assessment tool for a number of chemicals are compared with NHANES biomonitoring data and other modeling approaches.

Abstract Number	**P-1-08-14**
Presenter	Soon-Bark Kwon*, Youngmin Cho, Duck Shin Park, Young-Hwan Ko, Yun-Gyu Lee, Jungyun Lim, Suejin Kim
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

IAQ measurement of newly-manufactured express bus in the whole vehicle test chamber: Part I. Test Procedures

The objective of this study was to establish the test procedure of a newly-manufactured express bus in the whole vehicle test chamber for determining the level of volatile organic compounds (VOCs), and carbonyls inside vehicle. The test chamber of 34 m (L) x 6 m (H) x 6m (W) was utilized to provide the required environmental conditions (temperature, humidity, and background VOCs concentration). The chamber was equipped with solar radiator system with a radiation density of 400 W/m2±50 W/m2 using 130 halogen lamps covering the test bus and the solar rays were 30o inclined to deliver solar rays through the windows followed by the standard test methods of train coaches (UIC Code 553-1). Three modes of measurements were performed according to the international standard of ISO 12219-1 for whole vehicle test chamber specification and method for the determination of VOCs in cabin interiors; (1) ambient mode - in which sampling of VOCs and carbonyls under standardized temperature conditions, defined by 23oC, (2) parking mode – in which sampling of formaldehyde under standardized elevated temperature using solar radiation, (3) driving mode – in which sampling of VOCs and carbonyls under standardized conditions starting at elevated temperatures simulating driving after the vehicle has been parked in the sun. At each mode of test, air samples in the newly-manufactured express bus (mileage less than 500 km) were taken using air pump connected with TENAX TA and DNPH cartridge samplers at the positions of driver’s and passengers’ seats. Temperature profiles at 18 points including 3 points on ceiling, 4 points on seat surfaces, 6 points at the aisle with different heights, driver’s and passenger’s head height were recorded during the measurement in bus and 20 points of test chamber were also monitored. The whole test procedure was applied to 3 newly-manufactured express buses and the temperature variations due to solar radiation and air conditioning was analyzed with VOCs concentrations at each point.

Abstract Number	**P-1-08-15**
Presenter	Jihan Song*, Soon-Bark Kwon, Minhae Kim, Young-Kwan Yoon, Youngmin Cho, Young-Hwan Ko, Cheol-Woong Shin, Yun-Gyu Lee, Jungyun Lim, Suejin Kim
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

IAQ measurement of newly-manufactured express bus in the whole vehicle test chamber: Part II. Test Results

The objective of this study was to evaluate the types and concentrations of volatile organic compounds (VOCs) in the newly-manufactured express bus under three different modes of operation (ambient, parking, and driving modes) in the whole vehicle test chamber. The description of the chamber and the test procedure was presented by our previous Part I paper. Data were collected on 3 different newly-manufactured (mileage less than 500 km) express buses from three major manufacturers. Temperature and humidity of the test chamber and express bus was maintained at 23oC±2 oC and 50%±10% for ambient mode of test and indoor temperatures were increased up to 35~38 oC during the 8 hours solar radiation (parking mode) and decreased abruptly after the operation of air conditioner (driving mode). It was found that the toluene concentration was detected as highest (19,000 ~ 36,000 ug/m3) for 3 different buses at the parking mode. In case of ambient and driving modes, toluene concentration was in the range of 13,000~25,000 ug/m3. Xylene showed the second highest level ranging from 860~3,500 ug/m3, but it was not affected by the modes of operation. The concentrations of ethylbenzene, styrene and benzene were ranged between 40~500 ug/m3.

Abstract Number	**P-1-08-16**
Presenter	Ms Aakanksha, Ratna Katiyar*, S K Rastogi
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Impact of Biomass cooking fuels on indoor air quality in rural areas of Lucknow

emerged as an awakened dreaded giant due to, approximately half of the world's population still relies on biomass fuels (wood, charcoal, dung, crop residues). In rural India, most noxious indoor air pollutants are released as suspended particulate matter (SPM), CO, poly organic materials (POM's), polycyclic aromatic hydrocarbons (PAH's) along with intrinsic contaminants as S and trace metals, due to combustion products of unprocessed solid biomass fuels. Severe health hazards as chronic obstructive pulmonary diseases (COPD's) and lung cancer are encountered, posing threat to mankind. About half a million die annually form IAP in India. High magnitude of the problem posed an urgent need to assess the indoor air quality (IAQ) of rural households in Lucknow, thereby suggesting some remedial measures. Indoor air samples form rural houses using firewood, dung, crop residue were drawn from enclosed, open kitchens, living rooms while cooking and at non cooking times by air samplers. Respirable dust measurements were made by collecting samples via constant flow pumps. The concentrations of particulate matter (PM10) were measured by aerosol monitor. Kitchen measurements of CO, PM2.5, SO2 and NOX were estimated by using the emission of PAH which was monitored and analysed using HPLC. The finding revealed maximum concentration of CO2 (mean value 12 ± 3.4 ppm) among all the gaseous pollutants measured in the breathing zone in the indoor air samples during cooking period. The PAH level in the indoor air samples showed a very high concentration (957 µg/m3).The concentration of PM10 and PM2.5 measured inside the kitchen during biomass combustion (wood) was 3.7 times higher than the level of both the particles in the outdoor air. There is a significant health risk associated with increased concentration of gaseous pollutants and suspended particles including PAH. Thus, IAQ can be improved by more stringent bio monitoring studies and use of high efficiency cooking devices in rural areas.

Abstract Number	**P-1-08-17**
Presenter	Krystallia Kalimeri, Dikaia Saraga*, Evangelos Tolis, John Bartzis
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Indoor Air Quality in schools in the city of Kozani, Greece.

Background The need to achieve a good quality level in schools is because children spend more than 90% of their life indoors and almost 30% in schools. Children are more vulnerable and susceptible to air pollutants than adults. Poor indoor air quality in schools can reduce student's ability to learn and may cause short-term and long-term health effects. Aims This study aims to provide an insight to the school environment as well as knowledge on children's exposure to indoor air pollutants and possible health risks at school. The complex school environment, with various pollutant sources, makes it more difficult to identify the indoor air quality problems. Methods Two primary schools and one kindergarten were selected in the city of Kozani. In each school three classrooms and one outdoor position were monitored from Monday to Friday, in both summer and winter period. CO2, temperature and relative humidity were continuously monitored. VOCs, formaldehyde, NO2 and O3 were measured with diffusive samplers. Radon was measured for 4 weeks. PM2.5 was gravimetrically determined while particles size distribution (0.3-20μm) was measured with a spectrometer. CO was monitored every day and the ventilation rate for each classroom was calculated based on the CO2 decay rate. Results No major pollutant problems were identified for the three Greek schools that would require immediate remediation. Indoor air concentrations were within accepted limits with indicatively ranges of 1.5–9.4 μg/m3 for benzene, 2.3-28.5 μg/m3 for formaldehyde, 4.6-43 μg/m3 for NO2, 0.1-15.6 μg/m3 for O3, 19.5-129.8 μg/m3 for PM2.5 and 1509-4158 ppm for CO2. Conclusions Seasonal variations were noticed in all cases wherever comparison between summer and winter period was attainable. Whilst the ambient air may have a predominating influence on the levels of most indoor air constituents, occupant activities and materials found indoors were shown to contribute significantly to indoor pollution.

Abstract Number	**P-1-08-18**
Presenter	Matti Peltonen*, Arja Asikainen, Marko Hyttinen, Otto Hänninen, Philo Bluyssen, Corinne Mandin, Serena Fossati, Paolo Carrer, Eduardo de Oliveira Fernandes, John Bartzis
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Perceived indoor air quality in modern office buildings in Finland

Perceived indoor air quality in modern office buildings in Finland Keywords: Offices, surveys, perceived air quality Background: Indoor air quality has been identified as a significant determinant of health and comfort. Recent development of energy efficient buildings and corresponding tightening building regulations including requirements for sufficient ventilation and control of indoor air quality internationally and nationally potentially provide means for improvement. Aims: One of the objectives of the EU FP7 funded Officair project was to investigate indoor air quality and experienced health in modern office buildings that have been in use for 2-10 years. Methods: In Finland 19 office buildings in five cities (Kuopio, Joensuu, Mikkeli, Varkaus and Helsinki metropolitan area) were selected for the study and the employees working in these buildings participated in an online questionnaire on their health and indoor air quality. Results: 793 out of 4476 workers filled in the questionnaire. 72 % of them reported to experience some health problems and 41% out of them suspected the symptoms to be related to the office environment. The most common health problems reported were blocked or stuffy nose (39 %), dry eyes (35 %), dry skin (30 %), dry or irritated throat (27 %) and watering or itchy eyes (26 %). The most common problems related on the working environment were reported to be noise (45%) and too dry air (43%). The results indicate that sex, background disease diagnosed by a doctor, the geographical location of the office building, distance to a busy street and the type of the ventilation system are related on the prevalence of experienced health problems. Conclusions: The study provides up-to-date information on indoor air quality, office environment and experienced health problems in modern office buildings. This study is part of a European wide analysis of similar factors, allowing for a later comparison between climatological regions, building techniques and other relevant factors.

Abstract Number	**P-1-08-19**
Presenter	Bijaya Kumar Padhi*, Vinod Kumar Jain, Pinaki Panigrahi
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Residential exposure to household air pollution and its effects on children's respiratory health

Background: Epidemiologic studies have linked proximity to major pollution sources with adverse health outcomes, including respiratory symptoms, asthma, adverse birth outcomes, and cardiopulmonary morbidity. Household air pollution (HAP) from solid biomass fuel combustion is one of the major air pollution sources in developing countries and linked with child mortality. Aim: Residential exposure to HAP from neighbourhood cooking or heating may be associated with child mortality and there is a need to quantify the exposure–response relationship. Methods: Households used liquid petroleum gas (LPG) as a cooking fuel and proximity (<50m) to households used biomass fuel, were monitored for indoor/outdoor variation of PM2.5 and further characterization for EC, OC, K+. Children (n=205) aged 8-10 years and satisfied the above criteria were enrolled and investigated for respiratory health outcomes. We obtained health information and home environmental factors by parental questionnaire. Pulmonary function tests are performed using spirometry. Urinary levoglucosan was investigated and correlated with K+ concentration in indoor PM2.5. Results: The average indoor PM2.5 concentration of households located <50m to biomass burning households was 105.0±30.8 µg/m3, consisting of 48.6±8.5 µg/m3 of OC, 8.4±2.6 µg/m3 of EC and 15.2±6.5 µg/m3 of K+. Statistically significant correlation was found between urinary levoglucosan and indoor K+. Using multivariate logistic regression analyses, we found associations between respiratory illness and residential proximity to biomass fuel combustion. We observed a decline in PEF and FEV1 values (38% and 47% respectively). Most of the children (78%) experienced cough and phlegm production. Conclusions: The study findings provide evidence that neighbourhood biomass fuel combustion can affect the indoor air quality of households even used cleaner cooking fuel and, proximity to households used biomass fuel is associated with adverse respiratory health effects in children.

Abstract Number	**P-1-08-20**
Presenter	Ana Maria Scutaru*
Exposure	household air pollution
Health domains	other
Type of research	others

Sensory-based Evaluation of Building Product Emissions – Integration of Sensory Tests in the AgBB-Scheme

Indoor air quality may be strongly influenced by emissions of volatile organic compounds (VOC) from building products. VOC emissions are frequently accompanied by odours which may also lead to health disorders or lack of concentration. In Germany, in 1997 the Committee for Health-related Evaluation of Building Products was established. This Committee has developed criteria for testing and evaluating VOC emissions from building products in emission chambers establishing a uniform and reproducible health-related evaluation of building products. The AgBB scheme has been integrated into the approval procedure for selected construction products in Germany by the Deutsche Institut für Bautechnik (DIBt) since 2004 and in this context it is a mandatory scheme. According to the AgBB-scheme VOC emissions are measured after 28 days ventilated storage in a test chamber. Due to the potential odour perception caused by VOC the AgBB has also included since the beginning the sensory test as an important element of the evaluation scheme. The methodology for the measurement of odours has been only recently developed. The know-how gained in the last few years will now be tested in a 2-year pilot phase in cooperation with the manufacturers to practically check to what extent the assessment of odours from building products can be made. In the pilot phase the manufacturers are asked to test their products on a voluntary basis. Two round robin tests with the measurement institutes will be performed to test the reproducibility of the methodology for the assessment of odours. The results of the sensory tests will be gathered and evaluated by a coordinating body. The pilot phase will be accompanied by a working group consisting of some AgBB-members, some industry representatives and the coordinating body. The results of the pilot phase will be evaluated in an expert meeting.

Abstract Number	**P-1-08-21**
Presenter	Juan Wang*, Baizhan Li, Qin Yang, Han Wang, Dan Norbäck, Jan Sundell
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Sick Building Syndrome (SBS) among parents of preschool children in relation to home environment in Chongqing, China

Background: There are few studies on sick building syndrome (SBS) in China. Aims: To study association between SBS in Chongqing adults, with preschool children, and home environmental factors. Methods: The present study is part of a large Chinese multicenter study (China, Children, Homes, Health, CCHH). Parents of 3-6 years old children from randomly selected kindergartens in Chongqing, China returned completed questionnaires (one/child) between December 2010 and April 2011 (response rate 74.5%). There were questions on parents' SBS in the last 3 months (12 questions, categorized to general symptoms, mucosal symptoms and skin symptoms) (every week; sometimes; never). The association between parents' SBS symptoms and home environment were analysed by multiple logistic regression, controlling for gender and a history of asthma, allergic rhinitis or eczema. Results: The prevalence of SBS (every weekcompared with never) among 4950 participants were: 11.4% for general symptoms, 7.1% for mucosal symptoms and 4.4% for skin symptoms. Living near a main road or highway was a strong risk factor for general symptoms (adjusted odds ratio, aOR=2.16, P<0.001), skin symptoms (aOR=2.69, P<0.001), and mucosal symptoms (aOR=1.63, P<0.01). Redecoration was a risk factor for general symptoms (aOR=2.00, P<0.001), skin symptoms (aOR=1.66, P<0.01), and mucosal symptoms (aOR=1.66, P<0.05). New furniture was a risk factor for general symptoms (aOR=2.16, P<0.001) and skin symptoms (aOR=1.67, P<0.01). Dampness related problems (mould spot, damp stain, water damage and condensation) were all risk factors for SBS (aOR ranged from 1.68 to 3.98), as was the presence of cockroaches, rats, mosquitoes/flies and use of incense. Protective factors included cleaning the child's bedroom every day and frequently exposing bedding to sunshine. Conclusions: Parents' SBS were related to factors of the home environment.

Abstract Number	**P-1-08-22**
Presenter	Rima Habre*, Brent A. Coull, Annette Rohr, Erin Moshier, Amit Nath, William Castro, Avi Grunin, James Godbold, Neil Schachter, Meyer Kattan, Petros Koutrakis
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure modeling

Sources of Indoor Air Pollution in Residences of Asthmatic Children in New York City

Background: The indoor environment contributes significantly to individuals' personal exposure to particulate matter (PM) and gaseous air pollution since individuals spend around 90% of their time indoors in close proximity to sources. Aims: To separate indoor concentrations of PM2.5 mass, elements, and thermally-resolved carbon fractions based on their origin and to identify their main sources in New York City residences of asthmatic children. Methods: The sulfur tracer method was used to separate weekly indoor concentrations into fractions of indoor versus outdoor origin. Enrichment factors relative to sulfur concentrations, non-parametric correlations and mixed models were used to identify building characteristics, resident activities and specific indoor sources that contributed to observed concentrations. Results: Significant indoor sources were detected for NO2, OC1, K and Cl. The elements Al, Ca, Fe, Cu, Si, Zn and EC1 and remaining OC fractions were of mixed origin. O3, SO2, S, Br, Mn, Ni, Pb, Ti and V were predominantly of outdoor origin. We attributed 46% of indoor PM2.5 mass to indoor sources related to OC of indoor origin, including cooking (OC1, OC, NO2, Si and Cl), cleaning (OC1 and OP), candle/incense burning (BC) and smoking (K, OP, OC1, OC and EC1). Outdoor sources accounted for 28% of indoor PM2.5 mass, mainly photochemical reaction products, metals and combustion products that infiltrated indoors (EC, EC2, Br, Mn, Pb, Ni, Ti, V, S). Other indoor sources accounted for 26% of the mass and included re-suspension of crustal elements and metals (Al, Zn, Fe, Si and Ca). Conclusions: The composition of PM2.5 in the indoor environment can vary significantly depending on its various sources. Combining detailed compositional information, passive nicotine measurements, and questionnaire variables allowed us to characterize indoor exposures of high relevance to health effects in asthmatic children.

Abstract Number	**P-1-08-23**
Presenter	Youngmin Cho*, Soon-Bark Kwon, Duck Shin Park, Woo-Sung Jung, Tae-Wook Kim
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	case-control study

Study On The Effect Of Door Opening On The Temperature Distribution In the Urban Transit Cabin In Winter Season

Global warming causes more frequent observation of extraordinarily hot summer or cold winter. Therefore, the requirement of passengers on cooling or heating performances of urban transit cabin is drastically increasing. Usually, urban transit car opens its door every 2~5 minutes because the distance between each stop is not that long. During this door opening, hot or cold air of platform comes into the cabin, and the thermal comfort of passengers is seriously lowered. However, there has not been significant effort to reduce this discomfort. In this study, the change in cabin temperature distribution during door opening was investigated with the ambient temperature was set at 0 °C. The door opening time was varied from 15 s to 90 s while the door closing time was kept at 2 min. The same cycle was repeated for 10 times. The cabin temperature dropped more when the opening time was longer. Similarly, the door closing time was varied from 30 s to 4 min while the door opening time was fixed at 30 s. When door closing time was longer, the temperature could be more closely recovered to the indoor temperature before starting the experiment. Fans were used to reduce the temperature drop during the door opening. The effects of wind direction were also studied.

Abstract Number	**P-1-08-99**
Presenter	Leonid Turczynowicz*, Dino Pisaniello, Neville Robinson
Exposure	household air pollution
Health domains	other
Type of research	exposure measurement

Indoor Inhalation Exposure from Vapour Intrusion - Time Dependent Considerations in Modelling and Measurement

Background Vapour intrusion is assessed by modelling and measurement. Uncertainty in modelling has led to increased measurement and a weight-of evidence approach to address human indoor exposures and health risks. A time-dependent approach is suggested comprising subsurface phase partitioning, fate and transport; dwelling ventilation and human inhalation dosimetry. Both ventilation and dosimetry warrant attention in measurement and modelling development. Aim Pilot program to assess ventilation influences and an Australian non-steady-state vapour intrusion model. Methods A xylene-spiked termiticide emulsion was applied to the sub-floor space of a cavity brick home in Adelaide. Testing was done on soil particle density, organic carbon fraction, water filled porosity, dry bulk density, moisture, sub-floor and indoor air xylene concentrations (active/PID) and air exchange rates and meteorological data collected. These data and published degradation data were used in modelling. Results Sub-floor xylene air levels were greater than those in the living space with a decline reaching limits of reporting within two weeks. Air exchange in sub-floor space was an order of magnitude higher than indoor sub-floor space. Continuous PID sampling provided greater resolution of air volatile changes in both compartments. Diurnal variability in decline of indoor air levels was more marked than in the sub-floor space. Modelling of indoor air levels (max. 254 mg/m3) showed consistency with measured data (max. 174 mg/m3) but reported a more rapid decline (ten-fold). Conclusions Observations included a rapid elevation and decline in sub-floor and indoor air concentrations; significant influence of sub-floor ventilation and meteorological factors on indoor air concentrations; and, diurnal trends suggesting increased indoor exposures during occupancy periods. The influence of diurnal variation on indoor time-dependent inhalation exposures with high resolution measurement is the focus of future work.

Abstract Number	**P-1-10-01**
Presenter	Miguel Rodríguez-Barranco*, Marina Lacasaña, Clemente Aguilar, Juan Alguacil, Fernando Gil, Beatriz Gonzalez Alzaga
Exposure	metals
Health domains	neurodevelopment
Type of research	meta-analysis

A META-ANALYSIS OF THE ASSOCIATION OF ARSENIC AND MANGANESE EXPOSURE WITH NEURODEVELOPMENT IN CHILDREN

Aims: To estimate the effect of exposure to arsenic (As) and manganese (Mn) on child neurodevelopment pooling the results of the studies published to date. Methods: Systematic review of original articles from January 2000 until March 2012, that evaluate effects on neurodevelopment due to pre or post natal exposure to arsenic and manganese in children up to 16 years of age. We excluded articles based on case studies or case series, ecological designs, literature reviews and those that only evaluated exposure to arsenic and manganese indirectly through questionnaires. We performed a meta-analysis including studies that assessed the intelligence quotient (IQ) with some version of the Wechsler scale and used linear regression to estimate the effect. The results in each study were homogenized prior to eliminate the influence of different logarithmic transformations. All effects were expressed for increased exposure of 50% and the results were combined using a random effects model. Results: Of the 27 articles derived from the systematic review that met the inclusion criteria, 10 could be included in the meta-analysis. Exposure was mainly measured by determining exposure biomarkers in urine and drinking water (in the case of As) and in hair and blood (Mn). The results of the meta-analysis suggest that for every 50% increase in As levels in drinking water there is a significant decrease of -0.6 points (95% CI: -1.1, 0.01; p=0.052) in the IQ of children aged 5-15 years. Furthermore a 50% increase in As levels in urine would be associated with a decrease of -0.4 points (95% CI: -0.8, 0.1; p=0.090). In relation to the Mn, an increase of 50% in hair levels would be associated with a significant decrease of -0.7 points (95% CI: -1.1, -0.3; p<0.001) in the IQ of children aged 6-13 years. Conclusions: There is evidence that relates arsenic and manganese exposure with neurodevelopment problems in children. The combination of the results of the studies would produce an estimate of the effect size more accurately than those reported in each study individually.

Abstract Number	**P-1-10-02**
Presenter	Suzanne McDermott*, Weichao Bao, Bo Cai, Andrew Lawson, C. Marjorie Aelion
Exposure	arsenic
Health domains	neurodevelopment
Type of research	cohort study

Are different soil metals during pregnancy associated with mild and severe intellectual disability in children?

Background: Intellectual disability (ID) is a lifelong disability that impacts performance in cognitive aspects of life and usually has its onset prior to birth. The causes of ID are multifactorial and a single specific insult is only identified in a minority of cases. Lead (Pb), mercury (Hg), and arsenic (As) are developmental toxicants that are associated with lower intelligence test scores in children, even at low levels of exposure. There is substantial evidence that metals cross the placenta and accumulate in fetal tissues. The reported exposure routes for pregnant woman are oral (fish consumption with Hg, hand to mouth for Pb), and dermatologic (handling Pb and As). However, there are no published reports of associations of metals by level of ID. Aim: We explored on the association of relatively low concentrations of metals, in the soil proximal to maternal residence during pregnancy, with ID and hypothesized different metals would be associated with mild verses severe ID. Method: We used a mixed methods design starting with a retrospective cohort from 1996-2002, of 10,051 pregnant mothers, soil sampling in the residential areas where these mothers resided during pregnancy, and follow-up of their children to determine if there was an ID outcome. We tested the soil, and then predicted the soil concentration at the maternal homes, and modeled the association with severity of the child's ID. Results: We found a significant association between mild ID and soil Hg (p=0.00). For severe ID, there was a significant association with the soil As and Pb (p=0.02). Conclusion: This is the first report of differential impact of metals in soil and severity of ID in children. Soil mercury concentration where the mother lived during pregnancy is associated with significantly increased odds of mild ID and a combination of arsenic and lead is associated with significantly increased odds of severe ID, controlling for maternal, child and neighborhood characteristics.

Abstract Number	**P-1-10-03**
Presenter	Katherine Moon*, Eliseo Guallar, Ana Navas-Acien
Exposure	arsenic
Health domains	cardiovascular disease
Type of research	meta-analysis

Arsenic Exposure and Cardiovascular Disease: An Updated Systematic Review

Background: Epidemiologic studies have related chronic exposure to high arsenic levels to cardiovascular disease, despite methodologic limitations of the available literature. At low-to-moderate arsenic levels, the evidence is inconclusive. Aims: We updated a previous systematic review (Am J Epidemiol 2005;162:1037–49) examining the association between arsenic exposure and cardiovascular disease. Methods: We evaluated all studies published before July 23, 2012 that assessed the relationship between arsenic exposure and clinical cardiovascular disease in the general population. Measures of association and their standard errors or 95% confidence intervals (CI) were abstracted or derived using the data reported in the publications. Combining the 13 studies from the previous review with 18 new studies, we calculated pooled relative risks by comparing the highest versus the lowest exposure category across studies. We also assessed study quality and evaluated dose-response trends. Results: For high exposure (arsenic in drinking water >50 µg/L), the pooled relative risks (95% CI) for cardiovascular disease, coronary heart disease, stroke, and peripheral arterial disease were 1.32 (95% CI: 1.05-1.67), 1.89 (95% CI: 1.33-2.69), 1.08 (95% CI: 0.98-1.19), and 2.17 (95% CI: 1.47-3.20), respectively. For low-moderate exposure (arsenic in drinking water <50 µg/L), the corresponding pooled relative risks (95% CI) for cardiovascular disease, coronary heart disease, stroke, and peripheral arterial disease were 1.06 (95% CI: 0.99-1.14), 1.06 (95% CI: 0.89-1.26), 1.07 (95% CI: 0.96-1.20) and 1.13 (95% CI: 0.77-1.66), respectively. Conclusions: This review strengthens the evidence for a causal association between high-chronic arsenic exposure and clinical cardiovascular endpoints. At low-moderate arsenic levels affecting most general populations, the evidence remains inconclusive. Additional high quality prospective studies are needed at low-moderate arsenic levels.

Abstract Number	**P-1-10-04**
Presenter	Faruque Parvez*, Yu Chen, Mahbub Yunus, Christopher Olopade, Stephanie Segers, Vesna Slavkovich, Rabiul Hasan, Alauddin Ahmed, Tariqul Islam, Joseph Graziano, Habibul Ahsan
Exposure	arsenic
Health domains	respiratory disease
Type of research	cohort study

Arsenic exposure and impaired lung function: findings from a large population-based prospective cohort study

Background: Exposure to water arsenic has been linked to respiratory symptoms, obstructive lung diseases and mortality from airway diseases. Limited evidence exists for the effects of water arsenic on lung function particularly among individuals exposed to a wide range of arsenic. Methods: In 950 individuals presenting with any respiratory symptom from a population-based cohort of 20,033 adults, we evaluated the association between arsenic exposure, measured by well water and urinary arsenic concentrations, and post-bronchodilator administered pulmonary function assessed during follow-up. Results: For every one standard deviation (SD) increase in baseline water As exposure, we observed a lower level of forced expiratory volume in 1 second (FEV1) (-46.5 ml, p<0.0005) and forced vital capacity (FVC) (-53.1 ml, p<0.01) in models adjusted for age, gender, body mass index, smoking, socioeconomic status, betel nut use, and skin lesions status. Similar inverse relationships were observed between baseline urinary arsenic and FEV1 (-48.3 ml, p<0.005) and FVC (-55.2 ml, p<0.01) in adjusted models. Our analyses also demonstrated a dose-related decrease in lung function with increasing levels of baseline water and urinary arsenic. This association remained significant in never smokers, individuals without skin lesions, and was stronger in male smokers. Among male smokers and individuals with skin lesions, every one SD increase in water arsenic concentration was related to a significant reduction of FEV1 (-74.4 ml, p<0.01 and -116.1ml, p<0.05) and FVC (-72.8 ml, p=0.02 and -146.9ml, p=0.004), respectively. Conclusion: This population-based study suggests that arsenic exposure increases the risk of impaired lung function in humans.

Abstract Number	**P-1-10-05**
Presenter	Helen Crabbe*, Rebecca Close, Mike Studden, Pauline Smedley, Louise Ander, Michael Watts, Alison Henley, Frank McColl, Amy Rimell, Giovanni Leonardi
Exposure	arsenic
Health domains	no health domain
Type of research	exposure measurement

Arsenic in private drinking water supplies: human health risk based on underlying geology

Background Revised regulations governing the quality of private drinking water supplies (PWS) were introduced in 2008 as EU Directives, and transposed into UK Regulations in 2009, but there is a lack of coordinated information on the geographical distribution of known hazards such as those related to arsenic (As) and underlying geology. Aim To explore a methodology for risk assessment of exposure to As in drinking water based on the underlying geology and exceedances of the permissible limit. Methods Households in Cornwall with a PWS were identified from a register and a subset was selected to represent areas of different underlying geology. Approximately 500 residents were invited to provide tap and borehole water samples and information on water use. Water samples were analysed for As and other chemical parameters by ICP-MS and ion chromatography. The geological classification of the bedrock was complex in the study area with a need to simplify the categorisation in order characterise exposure in relation to geology. The British Geological Survey simplified this to 8 categories for practical analysis. Results In the first phase of the study covering east Cornwall in 2011, 258 PWS were sampled. Out of the 8 simplified geologies, Mineralisation areas and Gramscatho were more likely to have higher levels of As than others. A possible risk variation by geology category was found, but statistical significance was only borderline. Households found to have water supplies with exceedances for As or other hazards were advised about re-testing and interventions such as water treatment. Conclusions Potential exposure of a proportion of the Cornwall population to As was identified. In relation to risk related to underlying geology, there is an indication that some geologies are more likely to have higher levels of arsenic than others. Results of further analyses in a wider sampling area will estimate the potential influence of geology on the exposure of the population.

Abstract Number	**P-1-10-06**
Presenter	Rebecca Close*, Dan Middleton, David Polya, Ovnair Sepai, Karen Exley, Helen Crabbe, Michael Watts, Pauline Smedley, Louise Ander, Mike Studden, Giovanni Leonardi
Exposure	arsenic
Health domains	other
Type of research	exposure measurement

Arsenic in private drinking water supplies: population exposure assessment validated by biomonitoring.

Background Safety of private drinking water supplies (PWS) is of concern globally. In the UK approximately 1 million people have a PWS. The South West of England has a particular natural and anthropogenic burden of inorganic arsenic (iAs) related to historical activities such as mining. iAs exposure via ingestion has a recognised risk of several cancers and other chronic diseases. Aim To estimate population exposure to iAs from PWS in South West England. Methods To survey a sample of residents with PWS and develop an exposure model comprising: 1. Analyses of iAs concentration in their current drinking water sources ; 2. Information on water intake at current and past residences, and identify other iAs exposure routes by individual face-to-face questionnaires; 3. Analyses of urine, hair and nails. Results In 2011 we sampled 250 households with PWS in Cornwall and analysed for 65 inorganic analytes, which found 6% of tap water samples had an iAs concentration >10 µg/L. A survey of an additional 250 households will be conducted in March 2013. Questionnaire information on all sources of exposure to iAs will be used to develop a population exposure model. All residents with a drinking water iAs concentration above 5 µg/L will be targeted for collection of urine, hair and nails, as well as a random sample of all other residents. Household level information on iAs concentration in PWS will be linked to individual level information from biological samples and exposure questionnaire. Hence, population exposure to iAs as well as overall body burden will be estimated. Conclusions An initial iAs exposure estimate was produced demonstrating likely exposure of a proportion of population. Next, results from biological samples and an exposure questionnaire will be used to produce a validated population exposure estimate. This information will help planning and implementation of prevention strategies.

Abstract Number	**P-1-10-07**
Presenter	Peter Rudnai*, Janos Sandor, Judit Beres, Julia Metneki
Exposure	arsenic
Health domains	reproductive outcomes
Type of research	case-control study

Arsenic in the drinking water and congenital heart anomalies

Background: There are very few human data on the teratogenic effect of arsenic exposure during pregnancy, though animal data suggest that such an effect may exist. Objectives: to study the possible associations between arsenic content of the drinking water and some congenital anomalies. Methods: Data for the years 1980-2003 were taken from the Hungarian Congenital Abnormality Registry (HCAR). The chosen birth defects were congenital heart anomalies (n=11443), club-foot (pes varus, n=3189) multiplex congenital anomalies (3026), Down syndrome (2008) and congenital hip dislocation (n=4769). Data on arsenic content of the drinking water in the settlements where the mothers of these babies lived during pregnancy were collected from archive data bases of the National Institute of Environmental Health. In 96.5% of cases the settlements were covered by this source of information. A cut-off point of 10µg/L arsenic concentration was chosen for analysing the associations between arsenic exposure and prevalence of the chosen birth defects by logistic regression using STATA/SE 9.2 software. Age of the mother and gender of the baby were adjusted for. Results: A significantly increased risk was observed for congenital heart anomalies in settlements supplied with drinking water with arsenic concentration above 10µg/L. (OR=1.34; 95% C.I.= 1.24-1.46) Both gender (being boys) and age of the mother (positively) were significantly associated with the prevalence of congenital heart abnormalities. Conclusion: Our study support the hypothesis that arsenic content of the supplied drinking water may cause congenital anomalies of the heart.

Abstract Number	**P-1-10-08**
Presenter	Akihisa Hata*, Kenzo Yamanaka, Hidetoshi Kurosawa, Yuko Yamano, Yoko Endo, Noboru Fujitani, Ginji Endo
Exposure	arsenic
Health domains	other
Type of research	health impact assessment

ARSENIC METABOLITES IN HUMAN URINE AFTER INGESTION OF SEAFOOD

Background and Aims: Seafood contains large amounts of various arsenic compounds, but their relative toxicities have not been fully evaluated yet. To evaluate the risk of dietary arsenic, we conducted a tuna and wakame seaweed ingestion experiment. Methods: Four volunteers ingested 300 g of sashimi tuna, and 5 volunteers ingested 300 g of wakame, after refraining from eating seafood for 5 days. Arsenic metabolites in urine were monitored over a 5-day period after ingestion. Arsenic contents of tuna and wakame were measured after bead-beating treatment with 50% methanol. Speciation analyses of arsenic were performed by HPL-ICP-MS. Results: The total amount of ingested arsenic from tuna and wakame was 2.6 and 0.6 mg, respectively. In the methanol extract of tuna, arsenobetain (AsBe) was the major component and at least 2 unidentified arsenic compounds were detected. In the wakame extract, arsenosugar 328 (AsSug328), AsSug482, and 1 unidentified arsenic species were detected. The major component was AsSug328. Approximately 40% and 30% of ingested arsenic from tuna and wakame were excreted via urine during 5 days of observation, respectively. The identified urinary arsenics after tuna intake were AsBe and dimethylarsinic acid (DMA). AsBe comprised ~80% of total urinary arsenic excreted over 5 days, and DMA comprised ~10% of it. The urinary excretion rate of AsBe reached 66.5 µg/h at 4 h after ingestion and that of DMA was 1.47 µg/h at 9 h. DMA, the major metabolite after wakame intake, comprised approximately 60% of the detected arsenic species. The urinary excretion rate of DMA reached 2.14 µg/h at 24 h after wakame intake. Conclusion: Since neither DMA nor inorganic arsenic was detected in seafood extracts, urinary DMA after tuna and wakame intake may be produced metabolically from unidentified arsenic species and AsSugs, respectively. Urinary DMA levels after tuna intake returned to the level before intake after approximately 24 h. In contrast, urinary DMA after wakame intake returned to the level before intake after ~90 h.

Abstract Number	**P-1-10-09**
Presenter	Jennifer Ong*, Esther Erdei, Robert Rubin, Carlyle Ducheneaux, Marcia O'Leary, K. Michael Pollard, Curtis Miller, Johnnye Lewis
Exposure	metals
Health domains	autoimmune disease
Type of research	cohort study

Associations among Autoantibodies, Total Blood Mercury, Fish Consumption and Proximity to High-concentration Sediment Arsenic Deposits in Cheyenne River Sioux Tribe Members

Mercury (Hg) is a ubiquitous toxicant throughout Cheyenne River Sioux Tribe (CRST) lands, and CRST members may be exposed to Hg through fish consumption (FC), which remains an important component of native culture and may supplement household subsistence. Arsenic (As) is also a concern due to the recent identification of high-concentration sediment deposits on CRST lands. Limited data exist in humans, but Hg is an immunotoxicant shown to induce autoimmune disease in rodents. As has been found to both suppress and stimulate the immune system in humans. The goals of this pilot study were to 1) ascertain whether total blood Hg levels (THg) reflect Hg exposure through FC and smoking, and 2) determine whether THg, FC and distance from As deposits associate with the presence of antinuclear antibodies (ANA) and specific auto-antibodies (sAuAb). During peak fishing season, we recruited 75 participants who regularly consume fish from CRST waters. Hg exposure through FC and smoking were assessed via two questionnaires. Whole blood samples were collected from all participants, and THg was measured using ICP-MS. Participant residence proximity to high-concentration As sites was used as a surrogate for As exposure. We measured ANA and sAuAb in serum and modeled them using demographic and exposure information as predictors. While female gender, age and FC were significant predictors of THg, self-reported smoking was not. 30.7% of participants tested positive for ANA at ≥ 2+; ANA significantly associated with gender and proximity to As. Female gender, age and FC were significantly associated with the number of elevated sAuAb. Although FC resulted in detectable body burden of Hg, THg alone did not correlate with the presence of ANA or sAuAb in this population. We are currently designing future studies to address CRST health concerns and further investigate the relationships among FC, environmental metal exposures and autoantibodies.

Abstract Number	**P-1-10-10**
Presenter	Anastasia Sugeng*, Paloma Beamer, Nathan Lothrop, Walter Klimecki, Melissa Cox, Sarah T. Wilkinson, Miranda Loh
Exposure	arsenic
Health domains	no health domain
Type of research	exposure measurement

Comparison of Inter-Home and Intra-Homes Variance of Arsenic in Children's Urine for Households Near a Hazardous Waste Site

Background:Children living near hazardous waste sites may be at an increased risk for exposure to environmental contaminants, such as metals. However, children in the same home and between different homes may not experience the same levels of exposure. Aim:The objective of this study was to compare the inter-home and intra-home variance of arsenic (As) in children's urine living near a hazardous waste site. Methods:Urine samples from 31 children living within a 5-mile radius of a contaminated mine tailings site in northern Arizona were collected and analyzed for arsenic species using ICP-MS. We used a one-way ANOVA to assess the variance of total and inorganic arsenic within and between homes, as well as by gender and age. Inorganic arsenic was the sum of As(III), As(V), DMA(V), and MMA(V). Results:Overall median creatinine-corrected urine levels of all children for total arsenic and inorganic arsenic were 12.06 µg/g and 9.20 µg/g, respectively. In households with multiple children, the median intra-home urine total arsenic levels ranged from 4.87 µg/g to 81.64 µg/g and inorganic arsenic levels ranged from 7.40 µg/g to 35.55 µg/g. Overall urine concentrations were higher in females for inorganic arsenic but higher in males for total arsenic. Children ages 1-3 had the highest median urine concentrations for total arsenic, while children ages 8-11 had the highest median concentration for inorganic arsenic. The variance between children's urine inter-homes was greater than intra-homes for both total arsenic (p=0.002) and inorganic arsenic (p = 0.01). The intraclass correlation coefficient showed a moderate correlation between children in the same home for inorganic arsenic (ICCIn_As =0.57) and total arsenic (ICCTo_As=0.68). Conclusion: These results suggest that children in the same households may receive similar exposures to environmental contaminants. Therefore, interventions that target high-risk households may be effective in decreasing exposures of children living near contaminated hazardous waste sites.

Abstract Number	**P-1-10-11**
Presenter	Akito Takeuchi*, Akira Namera, Yaeko Kawasumi, Tsutoshi Imanaka, Norihiro Sakui, Hirokazu Ota, Yoko Endo, Kimiaki Sumino, Ginji Endo
Exposure	arsenic
Health domains	other
Type of research	others

Development of analytical method for biological monitoring of inorganic arsenic exposure using gas chromatography-mass spectrometry

[Background] Inorganic arsenic (iAs) is methylated to monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA) in the human body, however, large amounts of DMA have been observed in the urine of individuals who habitually ingest seafood without occupational exposure to iAs. Therefore, sum of iAs and MMA concentration in urine is regarded as the suitable iAs exposure indicator. [Aims] The purpose of this study was to develop and validate an analytical method for the simultaneous determination of iAs [As(III) and As(V)] and MMA in urine by gas chromatography-mass spectrometry (GC-MS) for the biological monitoring of exposure to iAs. [Methods] Arsenic compounds (after reduction of arsenic to the trivalent state) were derivatized with 2,3-dimercapto-1-propanol, and then analyzed using a GC-MS. The proposed method was validated according to the US Food and Drug Administration guidelines. The accuracy of the proposed method was confirmed by analyzing a standard reference material (SRM) 2669 (National Institute of Standards and Technology). [Results] Calibration curves showed linearity in the range 1-100 µg/l for each of the arsenic species, with correlation coefficients of >0.999. For each of the arsenic species, the limits of detection and quantification were 0.2 µg/l and 1 µg/l, respectively. The recoveries were 96-100%, 99-102%, and 99-112% for As(III), As(V), and MMA, respectively. Intra-day accuracy and precision were 82.7-99.8% and 0.9-7.4%, respectively. Inter-day accuracy and precision were 81.3-100.0% and 0.8-9.9%, respectively. The analytical values of SRM 2669 obtained by the proposed method were sufficiently accurate. [Conclusions] The proposed method was a robust, selective, and cost-effective method suitable for routine analyses, and could be useful for the biological monitoring of occupational exposure to iAs.

Abstract Number	**P-1-10-12**
Presenter	Margaret Kurzius-Spencer*, Robin Harris, Jason Roberge, Mary Kay O'Rourke, Vern Hartz, Jefferey Burgess
Exposure	arsenic
Health domains	cancer
Type of research	cross-sectional study

Dietary inorganic arsenic intake in the U.S. and relation to serum matrix metalloproteinase-9 at different threshold concentrations of tap water arsenic

Arsenic (As) exposure is associated with cancer, chronic lung disease and cardiovascular disease, yet the mechanisms involved in As toxicity are not clearly understood. Matrix metalloproteinase 9 (MMP-9) has also been linked to these diseases, and, in earlier studies, we observed: 1) MMP-9 alterations in cultured lung cells exposed to As, 2) a positive association between As in drinking water and increased serum MMP-9 in humans, and 3) that the majority of As exposure in US populations was from food. The objectives of the current study are to evaluate the effects of dietary components of inorganic As intake on serum MMP-9 in subjects with household tap water As concentrations above and below 10 ppb, 5 ppb and 3 ppb. In a cross-sectional study of 215 adult subjects living in Arizona communities, 24-hour dietary intake was analyzed for inorganic As using published residue data, and As in cooking and drinking water was estimated from multisource water samples and reported consumption data. In mixed model regression, the sum of total inorganic As intake was positively associated with serum MMP-9, with and without adjustment for covariates. In adjusted models, dietary protein was a positive predictor and dietary folate, Hispanic ethnicity and age were statistically significant negative predictors. When total inorganic As intake was deconstructed into its component sources--dietary, drinking water and cooking water--, none of the sources were significant predictors. In models stratified by household tap water As, total inorganic As intake was consistently associated with serum MMP-9 among subjects exposed to tap water As below 10 and 5 ppb, but not above. Inorganic As from food alone was significantly associated with serum MMP-9 only among subjects exposed to household tap water As ≤ 3 ppb. Even in the U.S. where the average tap water As is 2.4 ppb, total inorganic As intake from food and water may contribute to As-induced changes in biomarkers associated with disease.

Abstract Number	**P-1-10-13**
Presenter	Miranda Loh*, Anastasia Sugeng, Nathan Lothrop, Walter Klimecki, Melissa Cox, Sarah T. Wilkinson, Paloma Beamer
Exposure	arsenic
Health domains	no health domain
Type of research	exposure measurement

Exposure to Metals in Environmental Media Near a Mine Tailings Site

Background: Residents near metal mine tailings sites may have higher exposures to certain metals. Aims: This study investigates whether there is a relationship between living near a former mine and smelter site in Arizona and exposure to metals, particularly arsenic (As) and lead (Pb), via soil, dust, and water. Methods: Metals were measured in residential soil, dust, water, urine and toenail samples from 31 children in 18 households up to 5 miles from a former mine and smelter site. Soil from the house perimeter and dust from vacuum bags were collected, sieved to <63 µm before nitric acid digestion and analysis via ICP-MS. Water and urine were analyzed without digestion, while toenails were washed, digested and analyzed. Blood lead was tested by an independent, certified laboratory. Spearman correlation coefficients were calculated between each environmental media and urine and toenails. Results: Geometric mean (GSD) As concentrations in soil and dust (<63 µm) were 29.4 (2.49) ppm and 11.0 (5.5) ppm. Concentrations in water were 8.04 (7.52) ppb. Geometric mean total urinary As was 12.7 (2.15) µg/g creatinine. Soil and dust values for Pb were 20.3 (2.07) ppm and 15.9 (5.71) ppm. The majority of water Pb concentrations and blood Pb were below the limit of quantification. Toenail As was 0.745 (3.42) µg/g and Pb was 1.27 (3.89) µg/g. Correlation coefficients for As were: water-urine 0.44, soil-urine 0.11, dust-urine 0.58, urine-toenails 0.003, water-toenail 0.34, dust-toenail 0.021, soil-toenail 0.044. Conclusions: Total urinary As was above the NHANES 2009 geometric mean for ages 6-11 years with about 16% of the children above the 90th percentile, indicating a possible local source of exposure. Urine appears to have a better correlation with environmental samples than toenails. Children do not appear to be highly exposed to lead from the tailing/smelter site. Further work will examine the spatial gradient between the site and environmental and biomarker levels, as well as other potential predictors of biomarker levels.

Abstract Number	**P-1-10-14**
Presenter	Shohreh Farzan*, Susan A. Korrick, Zhigang Li, Richard Enelow, A. Jay Gandolfi, Juliette Madan, Kari Nadeau, Margaret Karagas
Exposure	arsenic
Health domains	infectious diseases
Type of research	cohort study

In utero arsenic exposure and infant infections in a United States cohort: A prospective study

Background: Arsenic (As), a ubiquitous environmental toxicant, has recently been linked to disrupted immune function and greater infection susceptibility in highly exposed populations. Drinking water As levels above the EPA maximum contaminant level occur in our US study area and are a particular health concern for pregnant women and infants. Aims: As part of the New Hampshire Birth Cohort Study, we investigated whether in utero exposure to As affects risk of infant infections over the first year of life. Methods: We prospectively obtained information on infants (n=359) at 4, 8 and 12 months of age using a parental telephone survey ascertaining the frequency of infant infections and symptoms, as well as their duration and treatment. Using logistic regression and generalized estimating equation (GEE) models, we evaluated the association between maternal urinary As during pregnancy and infection over the first year of life adjusted for potential confounders. Results: Using logistic regression to examine types of infections and symptoms at each age (4, 8 and 12 months), we found significant increases in the occurrence of diarrhea resulting in a doctor visit (OR: 4.2; 95% CI: 1.3-13.7) in the first 4 months of life in association with maternal pregnancy urine As levels. Higher in utero As exposure was also associated with increases in infections and symptoms prescribed medication in the first 4 months, including lower respiratory infections (OR: 2.2; 95% CI: 1.1-4.5), respiratory syncytial virus (RSV) (OR: 3.0; 95% CI: 1.1-8.5), rhinorrhea (OR: 2.1; 95% CI: 1.2-3.9) and wheezing (OR: 3.2; 95% CI: 1.2-8.4). In the GEE analysis, in utero As exposure was related to lower respiratory infections requiring a prescription medication in the first year of life (OR: 1.8; 95% CI: 1.2-2.8). Conclusions: In utero As exposure may enhance the risk of infant infections, in particular those involving medical treatment, possibly reflecting more severe disease.

Abstract Number	**P-1-10-15**
Presenter	Yuko Yamano*, Kasuke Nagano, Kenzo Yamanaka, Akihisa Hata, Toshio Nakadate, Yoko Endo, Ginji Endo
Exposure	arsenic
Health domains	other
Type of research	others

In vivo study of arsine exposure in hairless mice: percutaneous absorption vs. whole-body inhalation

Background: Arsine (AsH3) is widely used in the semiconductor industry. Primary cause of death in exposure to workers is kidney damage due to hemolysis, but the mechanism and potential for percutaneous absorption are unclear. Aim: Mice were exposed to arsine to detect percutaneous absorption and determine the toxicity mechanism. Methods: Arsine gas was generated by reduction of arsenic trioxide with NaBH4. Male 5-week-old Hos:HR-1 hairless mice (n=4 each) were subjected to single percutaneous or whole-body inhalation exposure of arsine gas (ca. 300 ppm) for 5 minutes. Total arsenic in blood (T-As) was determined using an ICP-MS, and hematocrit values (Ht) were measured. Histopathological examination was performed 6 h after exposure, and liver, spleen, kidneys, and lungs were subjected to immunohistochemical hemoglobin (Hb) and HE staining. Results: Mice subjected to whole-body inhalation at 320 ppm had reddening around the eyes, purple skin, and listless behavior. No changes were observed in the percutaneous exposure group at 310 ppm. Ht values in the inhalation group decreased significantly ($p<0.02$), down to 16% after 3 h, and all blood samples were hemolyzed. T-As in the inhalation group was 9.0-14.2 mg/L, significantly higher than in the control group (<2.0 mg/L, $p<0.02$). In contrast, Ht and T-As in the percutaneous group were comparable to control group values. Histopathological changes were only noted in the inhalation group, with marked deposition of eosinophilic globules in the proximal convoluted tubules of the kidney, Kupffer cells of the liver, and red pulp in the spleen. No changes were noted in the lungs. Immunohistochemically, these eosinophilic globules reacted positively to hemoglobin antibody. Conclusion: In the present study, arsine was not absorbed through the skin. Findings for exposure to arsine further suggest that hemolysis occurs first, followed by release of Hb and accumulation in the proximal tubules of the kidney, ultimately leading to renal dysfunction.

Abstract Number	**P-1-10-17**
Presenter	Katherine Moon*, Eliseo Guallar, Jason G. Umans, Richard B. Devereux, Lyle Best, Kevin A. Francesconi, Walter Goessler, Jonathan Pollak, Ellen K. Silbergeld, Barbara V. Howard, Ana Navas-Acien
Exposure	arsenic
Health domains	cardiovascular disease
Type of research	cohort study

Low to Moderate Arsenic Exposure and Incident Cardiovascular Disease: The Strong Heart Study

Background: Inorganic arsenic exposure in water and food is a global public health problem. Chronic exposure to high levels of arsenic is consistently associated with an increased risk of cardiovascular disease. Prospective data on the association of low to moderate arsenic exposure with cardiovascular disease are lacking. Aims: To evaluate the prospective association between chronic low to moderate arsenic exposure and incident cardiovascular disease. Methods: We evaluated the association between chronic arsenic exposure and incident cardiovascular disease among 3,575 men and women aged 45-74 years who participated in the Strong Heart Study in 1989-1991 and were followed through 2008. We used the sum of inorganic and methylated arsenic species in urine at baseline as a biomarker of arsenic exposure and divided arsenic concentrations by creatinine to account for urine dilution. Urine arsenic is a good biomarker of chronic arsenic exposure in this population. Results: 1,184 participants developed fatal and non-fatal cardiovascular disease, including 846 coronary heart disease cases and 264 stroke cases. Comparing the highest to lowest quartile in arsenic concentrations (>15.7 vs. <5.8 µg/g creatinine), the hazard ratios (95% confidence interval) for cardiovascular, coronary, and stroke mortality after adjustment for socio-demographic and cardiovascular risk factors were 1.52 (1.10, 2.11), 1.57 (1.08, 2.27) and 2.75 (0.97, 7.81), respectively. The corresponding hazard ratios for incident cardiovascular disease, coronary heart disease, and stroke were 1.24 (1.02, 1.50), 1.21 (0.97, 1.52), and 1.32 (0.87, 2.00), respectively. These associations were stronger among men and current smokers. Conclusions: Low to moderate chronic arsenic exposure, as measured in urine, was prospectively associated with cardiovascular disease incidence and mortality. These findings support arsenic at low to moderate concentrations as an independent cardiovascular disease risk factor.

Abstract Number	**P-1-10-18**
Presenter	Michael Bloom, Simona Surdu, Iulia Neamtiu, Edward Fitzgerald*, Eugen Gurzau
Exposure	arsenic
Health domains	reproductive outcomes
Type of research	case-control study

Low-moderate drinking water arsenic is associated with an increased risk for spontaneous abortion among more highly educated women in Timis County, Romania

Background: Maternal exposure to inorganic arsenic (iAs) in groundwater at >10 µg/L was a risk factor for spontaneous pregnancy loss in several epidemiologic studies; however, these involved populations with extensive exposures. A far larger global population is exposed to mild-moderate iAs concentrations in drinking water (<10 µg/L). Aims: A preliminary evaluation of associations between drinking water iAs exposure and spontaneous pregnancy loss in Timis County Romania, an area known for mild-moderate groundwater iAs contamination. Methods: We recruited 150 women with incident spontaneous pregnancy losses of 5-20 weeks gestation as cases (median=8 weeks), and 150 women with ongoing pregnancies matched by gestational age (+1 week) as controls. Women received government funded, compulsory pregnancy services at a large urban medical center. Individual drinking water exposure histories were reconstructed using data collected by nurse-administered questionnaire, and weighted by iAs concentrations in reported primary and secondary residential sources measured using hydride generation-atomic absorption spectrometry. Results: Average concentrations of 0 to 175.1 µg/L iAs (median=0.52, 75th %tile=3.61) were measured for reported residential sources. The interquartile ranges for cumulative iAs doses across gestation were 0.0-3.23 µg/kg and 0.0-4.91 µg/kg, for cases and for controls, respectively (P=0.16). However, multivariable conditional logistic regression analysis indicates an interaction between formal education, as a proxy for socioeconomic status, and exposure (P=0.04), adjusting for age and cigarette smoking. Women completing high school are at a 26% increased risk for loss per 1 µg/kg increase in cumulative iAs exposure (OR=1.26), whereas women not completing high school are at a 3% increased risk (OR=1.03). Conclusions: Increased levels of iAs exposure via drinking water are associated with an increased risk for pregnancy loss, in particular for more educated women.

Abstract Number	**P-1-10-19**
Presenter	Yu-Mei Hsueh*, Chia-Chang Wu, Yung-Kai Huang, Chi-Jung Chung
Exposure	arsenic
Health domains	cancer
Type of research	case-control study

Polymorphism of Inflammatory genes and Arsenic Methylation Capacity are Associated with Urothelial Carcinoma

Background: Chronic exposure to arsenic can generate reactive oxidative species, which can induce certain proinflammatory cytokines such as tumor necrosis factor-alpha (TNF-a), interleukin-6 (IL-6) and interleukin-8 (IL-8). TNF-a, IL-6 and IL-8 have been shown to be involved in the development and progression of various cancers, including bladder cancer. Aims: This study aimed to investigate the joint effect of the polymorphismof TNF-a-308 G/A,IL-6-174G/C, IL-8-251 T/A and urinary arsenic profiles on urothelial carcinoma (UC) risk. Methods: This study evaluated 300 pathologically-confirmed cases of UC and 594 cancer-free controls.Urinary arsenic species were detected using high-performance liquid chromatography-linked hydride generator and atomic absorption spectrometry. The polymorphismof TNF-a-308 G/A, IL-6-174G/C and IL-8-251 T/Awere determined using polymerase chain reaction-restriction fragment length polymorphism. The joint effects on UC risk were estimated by odds ratios and 95% confidence intervals using unconditional logistic regression. Results: We found that theTNF-a-308 A/A and IL-8-251 T/T polymorphisms were significantly associated with UC. Moreover, the significant dose-response of the joint effect of TNF-a-308 A/A or IL-8-251 T/T genotypes and arsenic methylation indices were seen to affect UC risk. Conclusions:Our data provided evidence that subjects with high urinary total arsenic levels may experience an increased risk of UC if either IL-8-251 T/T or TNF-α A/A genotypes are present.

Abstract Number	**P-1-10-20**
Presenter	Takenori Yamauchi*, Yuko Yamano, Kenzo Yamanaka, Akihisa Hata, Yoshiki Kuroda, Yoko Endo, Ginji Endo
Exposure	arsenic
Health domains	other
Type of research	others

Possible Production of arsenic adduct due to the exposure of mouse preserved blood to arsine in vitro

Background: Arsine (AsH3), widely used in the semiconductor industry, is one of the most acutely toxic forms of arsenic, and its inhalation causes rapid and severe hemolysis. However, the underlying mechanism is unclear. Aims: To confirm the arsenic adducts, we examined preserved mouse blood exposed to arsine. Methods: Banked blood derived from male ICR mice was exposed to arsine generated via zinc reduction of arsenic trioxide with or without aeration. After exposure, the blood plasma (BP) was separated by centrifugation. BP from non-treated blood was used as a control. Each sample was diluted with 0.1% trifluoroacetic acid, mixed with matrix (2,5-dihydroxybenzoic acid, α-cyano-4-hydroxycinnamic acid, or sinapinic acid [SA]), and spotted on the target plate. Matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) analysis was conducted on all samples. Results: Regardless of aeration, hemolysis was observed in response to arsine exposure. Optimum spectra were obtained when samples were diluted 25 to 75 times and SA was adopted as the matrix. Two m/z peaks (15 and 15.6 kDa) and three groups of peaks (about 30, 46, and 61 kDa) specific to the samples exposed to arsine were acquired. The two observed peaks were considered likely arsenic adducts with globin given the m/z values, which were consistent with previous studies indicating arsenic adducts over 10 kDa. The three groups of peaks were considered to be hemoglobin and its degradation products. Each group included from two to four peaks, implying that arsine induces the segregation of heme. In contrast, only two peaks (33 and 66 kDa) specific to the control were obtained. Each peak was likely a globin dimer and hemoglobin, respectively. Conclusions: In this study, m/z peaks specific to either the exposed or control samples were observed. Arsine may induce hemolysis via formation of arsenic adducts with globin chains but further study will be required to elucidate the mechanism of hemolysis.

Abstract Number	**P-1-10-21**
Presenter	Lothrop Nathan*, Anastasia Sugeng, Miranda Loh, Walter Klimecki, Melissa Cox, Sarah T. Wilkinson, Paloma Beamer
Exposure	arsenic
Health domains	healthrelated quality of life
Type of research	exposure measurement

Relationship of Arsenic Concentration in Residential Yard Soil, Home Location, and Topography in a Community near a Superfund Site

Background: The Iron King Mine and Humboldt Smelter Superfund Site is located in northern Arizona adjacent to the town of Dewey-Humboldt, AZ. Community exposure to metals in residential yard soil deposited via windblown dust from the Site is a concern. Aims: The objective of this study was to examine the arsenic value of yard soil for homes within 3 miles of the Site in relation to homes' distance from the Site, elevation, slope, and underlying soil type. Methods: Approximately 140 grams of soil was collected from 18 homes around the yard perimeter. Each sample was sieved to the <63 µm size fraction and analyzed for a variety of metals using ICP-MS after microwave-assisted nitric acid digestion. Geographic information systems maps and Wilcoxon-Mann-Whitney tests were used to assess relationships between distance from the Site, elevation, slope, and underlying soil type. Results: The overall mean arsenic concentration in soil was 53.1 mg/kg. The 11 homes <1 mile from the Site had a mean arsenic concentration of 24.4 mg/kg with values ranging from 11.8 to 51.5 mg/kg; the 7 homes 1-3 miles from the Site had a mean arsenic concentration of 98.3 mg/kg with values ranging from 8.53 to 432 mg/kg. Homes <1 mile had a mean elevation of 1,386 meters and a slope of 3.23%; homes 1-3 miles had a mean elevation of 1,415 meters and a slope of 4.7%. Only elevation was statistically significant (p=0.0043) between homes <1 mile versus 1-3 miles away. There was no relationship between distance from the Site and underlying soil types. Conclusions: Homes at higher elevations in areas further from the Site may receive more windblown dust from the Site containing elevated levels of arsenic. These findings compliment wind event modeling that simulates dust blowing from the Site, through homes <1 mile away at lower elevations, then being deposited in areas with higher elevation. Soil sampling beyond 3 miles may illuminate the complex relationship between meteorological conditions, the area's topography, and soil arsenic values in relation to the Site.

Abstract Number	**P-1-10-22**
Presenter	Matthew O. Gribble*, V. Saroja Voruganti, Cheryl D. Cropp, Kevin A. Francesconi, Walter Goessler, Jason G. Umans, Ellen K. Silbergeld, W.H. Linda Kao, Shelley A. Cole, Ana Navas-Acien
Exposure	arsenic
Health domains	no health domain
Type of research	cross-sectional study

SLCO1B1 Gene Variants and Urine Arsenic Metabolites in the Strong Heart Family Study

Background. Arsenic species patterns in urine are associated with risk for cancer and cardiovascular diseases, and these patterns have often been interpreted as a measure of arsenic metabolism. However, other processes affecting toxicokinetics may influence urine arsenic species patterns. The transporter coded by SLCO1B1 has been shown to transport arsenic species in HEK-293 cells, but human population studies are lacking. Aims. To evaluate associations of urine arsenic metabolites with variants in the candidate gene SLCO1B1 in adults from the Strong Heart Family Study (SHFS). Methods. Arsenic species were measured by anion-exchange HPLC-ICPMS, and % arsenic species biomarkers were calculated as the (%) contribution of inorganic arsenic, monomethylarsonate (MMA) and dimethylarsinate (DMA) to their sum. We estimated associations between % arsenic species and 5 SNPs in the SLCO1B1 gene in 157 participants from 5 families. Linear regression models for the minor allele dose at each SNP accounted for kinships and were adjusted for sex, body mass index and study center. Results. The C allele of rs1564370 was associated with lower %MMA ($p = 0.0003$) and higher %DMA ($p = 0.0002$), accounting for 8% of the variance for %MMA and 9% for %DMA. The C/C genotype frequency was 17% and the C/G genotype frequency was 43% at rs1564370. The A allele of rs2291075 was associated with lower %MMA ($p = 0.0006$) and higher %DMA ($p = 0.0014$), accounting for 7% of the variance for %MMA and 5% for %DMA. The rs2291075 A/A genotype frequency was 1% and A/G genotype frequency was 15%. These two SNPs had correlation $r = 0.42$. Conclusions. Common variants in SLCO1B1 were associated with differences in urine arsenic species patterns in a candidate gene study. This may suggest that the % arsenic species interpreted as “arsenic metabolism” biomarkers reflect arsenic toxicokinetics more broadly. Replication of this finding in other populations and analyses with arsenic-related disease outcomes are needed.

Abstract Number	**P-1-10-23**
Presenter	Nathalie Saint-Jacques*, Patrick Brown, Trevor Dummer, Louise Parker
Exposure	arsenic
Health domains	cancer
Type of research	others

Spatial patterns in urinary tract cancer (UTC) risk in Nova Scotia (NS), Canada.

Background: UTC cancer rates in NS are amongst the highest in Canada. Understanding spatial variations in UTC risk is necessary to elucidate factors responsible for this excess risk. Arsenic (AS) in drinking water is an important risk factor in the development of UTC and one responsible for hundreds of thousands of deaths worldwide. NS’s AS-rich geological formation contributes to elevated levels of AS in many well water supplies. AS levels >700 µg/L have been observed in NS drinking water wells and levels >25 µg/L are common; these exceed the World Health Organization guidelines of 10 µg/L and overlap with levels of regions reporting significant arsenic-related health effects. Nearly 46% of Nova Scotians depend on unregulated private well-water sources. Aims: This study will assess the spatial distribution of UTC cancer in Nova Scotia. Methods: Kulldorf’s spatial scan statistic will be used to detect and locate cancer clusters. Local-EM kernel smoothing algorithm, which enables the combination of data spanning a long time period and subject to changing spatial boundaries, will be used to map disease risk. Inference and uncertainty estimates will be carried out with bootstrap procedures, and cross-validation will be used for bandwidth selection. 11,152 UTC cases diagnosed between 1980-2010, will be analyzed. Three AS-exposure indicators surfaces will detail spatial variations in AS-exposure based on 14,000 well-water samples. Results: A substantial proportion of the NS population was potentially exposed to AS-level exceeding guidelines. Indeed, 17% of water samples had AS-levels >10 µg/L, which provincially translates to over 70,000 people being exposed to elevated AS. This presentation will also show UTC mapping to identify the degree of geographic heterogeneity in cancer risk in NS. Conclusion: This study highlights the geographic variation in UTC cancer risk in NS, and will subsequently assess the relation between environmental exposure to AS and cancer risk.

Abstract Number	**P-1-10-24**
Presenter	David Wheeler*, Mary Ward, Dalsu Baris, Joanne S. Colt, Kenneth P. Cantor, Laura Beane Freeman, Margaret Karagas, Molly Schwenn, Alison Johnson, Debra T. Silverman
Exposure	arsenic
Health domains	cancer
Type of research	case-control study

Spatial-temporal analysis of bladder cancer risk in the New England Bladder Cancer Study

Background: Exploring spatial-temporal patterns of disease incidence can identify areas of significantly elevated or decreased risk, providing potential clues about disease risk factors and timing of exposure. Aims: We sought to explore the spatial-temporal risk of bladder cancer in three New England states in the United States. Methods: We examined bladder cancer risk in relation to residential location based on interview data from a large, population-based case-control study conducted in Maine, New Hampshire, and Vermont from 2001 to 2004 (N = 500 urothelial carcinoma case patients and 602 control subjects). Subjects in the analysis data set resided within the study area for the 25-year period before study enrollment. We used crude and adjusted generalized additive models to spatially model the probability of being a case. We adjusted for several important risk factors, including smoking history, occupational history, and exposure to drinking water contaminants (arsenic, disinfection by-product exposure). We evaluated models at several different time periods independently to explore the presence of significant risk areas in a time frame of etiologic relevance. We also modeled cumulative spatial risk over 25 years before diagnosis of disease. Results: Risk of bladder cancer varied over space and the pattern of unexplained risk was consistent in time windows of 5, 10, 15, 20 years before diagnosis and at time of diagnosis. Analyses stratified by French Canadian status revealed a distinct spatial pattern of unexplained risk among French Canadians. Conclusions: We found a significant association between spatial location and bladder cancer risk after adjusting for several important risk factors. Additional analyses of etiologic factors to determine the reason for this association will be presented.

Abstract Number	**P-1-10-25**
Presenter	Laura Zheng*, Jason G. Umans, Fawn Yeh, Kevin A. Francesconi, Walter Goessler, Ellen K. Silbergeld, Eliseo Guallar, Barbara V. Howard, Virginia M. Weaver, Ana Navas-Acien
Exposure	arsenic
Health domains	other
Type of research	cohort study

Urine Arsenic and Chronic Kidney Disease: Cross-sectional and Prospective Evidence from the Strong Heart Study

Background: Few studies have evaluated associations between low-moderate arsenic levels and chronic kidney disease (CKD). Our objective is to evaluate the cross-sectional and prospective association between inorganic arsenic exposure and reduced estimated glomerular filtration rate (eGFR; < 60 mL/minute/1.73 m2, CKD Stage 3) in American Indian adults from Arizona, Oklahoma, and North and South Dakota in the Strong Heart Study (SHS). Methods: 3,851 adults aged 45 – 74 years in 1989-1991 with urine arsenic and serum creatinine measures were used for the prevalence study. Prospective analyses were restricted to 3311 participants without reduced eGFR at baseline and with at least one follow-up visit between 1989 and 1999. Urine arsenic species were measured using high-performance liquid chromatography-inductively coupled plasma mass spectrometry. Plasma creatinine was measured by an alkaline picrate rate method. eGFR was estimated using the Modification of Diet in Renal Disease (MDRD) equation. Results: The prevalence of reduced eGFR at baseline was 10.2%. The multivariable-adjusted OR of prevalent reduced eGFR comparing the 75th to the 25th percentile for the sum of inorganic and methylated arsenic was 0.67 (0.55, 0.82). The incidence of reduced eGFR over the study period was 15.4%. The multivariable-adjusted hazard ratio of incident reduced eGFR comparing the 75th to the 25th percentile of urine arsenic concentrations was 1.17 (1.00, 1.37) before adjustment for diabetes and fasting glucose and 1.09 (0.92, 1.28) after adjustment for those variables. Conclusion: Increasing urine arsenic concentrations were inversely associated with prevalent reduced eGFR. Conversely, baseline urine arsenic levels were positively associated with incident reduced eGFR before but not after diabetes and fasting glucose adjustment. Repeated measures of arsenic exposure and renal dysfunction endpoints are needed to further characterize the association between urine arsenic and kidney disease.

Abstract Number	**P-1-12-01**
Presenter	Elaine Fuertes*, Barbara K Butland, H. Ross Anderson, David P. Strachan, Michael Brauer
Exposure	climate change (temperature)
Health domains	allergies
Type of research	cross-sectional study

A Global Analysis Of Associations Between Climate, Vegetation And Intermittent And Persistent Rhinitis Prevalence

Background: The potential impacts of climate change and its effects on vegetation growth on rhinitis and associated health effects are uncertain. Aims: To examine country-level associations between climate measures and the normalized difference vegetation index (NVDI) on intermittent and persistent rhinitis symptoms in a global context. Methods: The prevalence of persistent (symptoms for > two consecutive months) and intermittent (> one symptom report but not for two consecutive months) rhinitis symptoms among teenagers 13/14 years was calculated for 222 centres in 94 countries participating in ISAAC Phase 3. Linear regression mixed-models adjusted for gross national income and population density assessed associations between the centre prevalence of intermittent and persistent symptoms and temperature, precipitation, vapor pressure, and vegetation. Results are here presented as average change in country-level prevalence per 100 children per one interquartile increase in country-level exposure. Results: Intermittent symptoms were positively associated with mean (6.44 95%CI:[3.54, 9.33] per 10.3oC), maximum (2.45 [0.28, 4.62] per 4.6oC) and minimum (6.39 [3.83, 8.94] per 14.5oC) monthly temperature, and negatively associated with the difference between the maximum and minimum monthly temperature measurements (-6.53 [-9.25, -3.81] per 12.5oC). Similar trends were observed for vapor pressure. All measures of precipitation except the monthly minimum were positively associated with intermittent symptoms. Persistent symptoms were not significantly associated with any exposure considered. Results were similar after adjusting for climate type and when restricting to children also reporting itchy-eye symptoms. Conclusions: Given the several significant associations observed in this global study between indicators of climate and intermittent rhinitis symptoms, future changes in climate and resulting changes in vegetation may affect the prevalence of rhinitis.

Abstract Number	**P-1-12-02**
Presenter	Jayeun Kim*, Ho Kim
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	case-crossover study

Absolute Temperature Mean Changes and Emergency Department Visits for Asthma in Seoul, Korea: A Case-Crossover Study

Background Although weather changes are known to cause asthma symptoms, there were not many studies how absolute daily temperature change affect on asthma and their impact on asthma-related health-care utilization is poorly understood. Aims The objective of the present study was to determine the associations between absolute temperature mean changes (ATMC) and asthma-related emergency department (ED) visits among all ages in Seoul, Korea in 2007-2010. Methods Descriptive analyses of patient and ED visit characteristics were performed. A case-crossover study utilizing time-stratified controls was conducted to determine the impact of ATMC which is absolute temperature change between the day of event and 1 to 7 days prior to the asthma ED visits. We defined ATMC07 as average of absolute daily mean temperature change between ED visit day through 7 days prior of the event. Multivariable conditional logistic regression demonstrated the relation between ED visits and ATMC after controlling for other weather, pollutant measures, and week of influenza. Results The case-crossover study showed a statistically significant relation between asthma-related ED visits and ATMC in winter while there was no significant relation with daily temperature and the rest of seasons. The results showed the effect size respectively after adjustment for daily mean air pressure, daily mean relative humidity, daily maximum of sulfur dioxide, nitrogen dioxide, and PM10 ; ATMC01 (odds ratio = 1.020, 95%CI 1.001-1.040), ATMC02 (odds ratio= 1.033, 95%CI 1.005-1.062), ATMC03, (odds ratio=1.041, 95%CI 1.008-1.075) , ATMC04 (odds ratio=1.051, 95%CI 1.012-1.091) , ATMC05 (odds ratio=1.060, 95%CI 1.017-1.105) , ATMC06 (odds ratio=1.052, 95%CI 1.007-1.098) , ATMC07 (odds ratio=1.048, 95%CI 1.000-1.098). Conclusions We found that the association between asthma-related ED visits and the absolute temperature mean change is significantly strong in winter and larger ATMC causes more frequent asthma-related ED visits.

Abstract Number	**P-1-12-03**
Presenter	Vladimir Kendrovski*, Margarita Spasenovska, Maria Kisman, Allison Thorpe, Bettina Menne
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	health impact assessment

ADDRESSING THE PUBLIC HEALTH IMPACT IN MACEDONIA: THE CLIMATE CHANGE ADAPTATION STRATEGY IN HEALTH SECTOR

Background. Scenarios for Macedonia anticipate an average increase of 3.8 °C by 2100, more frequent and more intense heatwaves, droughts and flood events.Climate change adaption has been established as a priority within existing international and national policy instruments. The findings of a national health vulnerability, impact and adaptation assessment of climate change carried out in the country as part of a WHO/BMU seven countries initiative will be present. Aims.The aims were to assess the health effects of climate change and to develop a national adaptation strategy and action plan. Methods.A variety of qualitative and quantitative methodologies were used: Literature reviews, interviews, focus group, time series and regression analysis, damage and adaptation cost estimation, scenario based assessment, and stakeholder engagement. The development of a national adaptation strategy followed a public health strategy process developed by the WHO Europe. Results. An increase in maximum daily temperatures influences the daily distribution of total mortality during the heatwaves. Climate change-attributed costs of approximately € 2.6 million were calculated. Projected direct health impacts include higher salmonellosis degree increase in weekly temperature, an increase in pollen distribution in early spring, and a change in the presence of vectors. Conclusions. The generation of a robust evidence base, a coordinated and systematic approach to climate change research and the development of robust stakeholder engagement can be used to support the formulation and implementation of sustainable, multisectoral strategies and promote adaptive capacity.

Abstract Number	**P-1-12-04**
Presenter	Chris Fook Sheng Ng*, Kayo Ueda, Masaji Ono, Hiroshi Nitta
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Apparent temperature and heatstroke-related emergency ambulance dispatches in the Kanto area of Japan: When does the tragic relationship first begin?

Background: Rising heatstroke cases in recent years has prompted the urgency to understand how atmospheric temperature affects heatstroke-related ambulance services in Japan. Aims: A time-series study was conducted to examine the association between apparent temperature and daily heatstroke related ambulance dispatches within the Kanto metropolitan area in Japan. Methods: A total of 12,907 heatstroke-related emergency dispatch cases occurring from 2000 to 2009 in five major cities – Saitama, Chiba, Tokyo, Kawasaki, and Yokohama – were analyzed. Generalized Additive Models and Zero-inflated Poisson regressions were used to estimate the effects of daily maximum 3-hour apparent temperature (AT) on dispatch frequency from May to September, with adjustment for seasonality, long-term trend, weekends, and public holidays. Linear and non-linear exposures were considered. Effects on days when AT first exceeded its median in the warm season were also investigated. City-specific estimates were combined using random effects meta-analyses. Results: The adjusted relationship between AT (2-day average) and heatstroke-related dispatches had a “j-shape”. Significant risk increase began from 21°C with a combined relative risk (RR) of 1.22 (95% confidence interval: 1.03–1.44), increasing to 1.50 (1.42–1.58) at peaked AT. When linear exposure was assumed, combined RR was 1.44 (1.38–1.49) per degree increment. Associations were significant on days when median AT was initially exceeded in a particular season, especially in Tokyo. Over two-thirds of these initial hot days were in June. There were more heatstroke-related dispatches on weekends, but not on public holidays. Conclusions: Significant increase of heatstroke-related dispatches began rather early in June suggesting the harmful effect of the initial warming of weather despite the generally mild temperature. Risk increase that began early at low perceived temperature implies the need for early prevention.

Abstract Number	**P-1-12-05**
Presenter	Hyo-Mi Kim*, Jong-Tae Lee
Exposure	climate change (temperature)
Health domains	allergies
Type of research	time series study

Assessing the heat and cold effect of temperature on hospitalization and outpatient by allergic rhinitis in Seoul, Korea

BACKGROUND Many studies have investigated the association between the air pollutants and allergic disease with adjusting the temperature effect as confounding factor. The researches assessing the temperature effect on allergic disease are relatively small. The prevalence of allergic rhinitis (AR) in Korea is 14.5%, and it has been increasing steadily. AIMS In this study, we assess the lag effect of temperature on hospitalization or outpatient by AR at different sex or age group in Seoul, Korea. Also, we estimate both the heat and cold effect on AR. METHODS The distributed lag non-linear model was used to examine the lag effect of temperature on daily hospitalization or outpatient by AR. And then generalized additive model was used to estimate the cumulative relative risk (RR) for heat and cold effect of temperature, adjusting air pollutants, humidity, day of week, influenza epidemic, and long-term trend. RESULTS The lag effects of cold and heat temperature in total subject were estimated up to 21 days and on the day of hospitalization, and up to 12 days and on the day of visit in outpatient. The estimated RR for cold and heat effect in total subjects are 1.07(95%CI=1.01,1.33) and 1.33(95%CI=1.17,1.50) for hospitalization, and 0.88(95%CI=0.84,0.93) and 1.02(95%CI=0.93,1.11) for outpatient. The estimated lag effects of temperature by sex or age group were differed from estimated total subject. In addition, the results from estimated RRs for each age groups showed that the adolescent group (13≤age≤18) was most greatly influenced by heat (1.38(95%CI=1.13,1.68)) and cold (2.44(95%CI=1.72,3.46)) temperature in hospitalization by AR. Adjustment of the air pollutants by each or altogether, the estimated RRs do not show significant difference. CONCLUSIONS We found that there were different lag structures by sex or age group on AR. After considering the lag structure for each sex or age group, the result showed that the adolescents were most influenced by temperature on hospitalization by AR. Further investigation is needed in order to confirm these results.

Abstract Number	**P-1-12-06**
Presenter	Amar Mehta*, Laura Kubzansky, Brent A. Coull, Itai Kloog, Petros Koutrakis, David Sparrow, Avron Spiro III, Pantel S. Vokonas, Joel D. Schwartz
Exposure	ambient air pollution
Health domains	mental health
Type of research	cohort study

Associations between Short-term Changes in Air Pollution and Perceived Stress: the VA Normative Aging Study

Background: Few studies have investigated the effects of ambient air pollution on psychological stress. Aims: We evaluated associations between short-term changes in air pollution and non-specific perceived stress in a cohort of older men in the Boston metropolitan area. Methods: This longitudinal analysis consisted of 1,001 elderly male participants in the VA Normative Aging Study between 1995 and 2007 with 1 to 5 visits (n visits = 2,502). At each visit, participants were administered the 14-item Perceived Stress Scale (PSS), which quantified stress rating for the previous week and ranged from 0 to 56 in direction of increased stress. We developed mixed effect regression models of PSS score, with random intercept for participant, as a continuous function of interquartile range (IQR) increase in exposure to fine particles (PM2.5), particle number counts (PNC), black carbon (BC), nitrogen dioxide (NO2), ozone (O3), and sulfates (SO42-) at moving averages of 1 day up to 14 days prior to visit. All models were adjusted for age, race, education, census-tract level socioeconomic characteristics, antidepressant medication use, seasonality, meteorology, and day of week. Results: Statistically significant ($p<0.05$) positive associations were observed between PNC, NO2, and PM2.5, and PSS score for several moving averages. The strongest associations were observed for 2-day average PNC (IQR: 17,360 count/cm3; β: 2.8, 95%CI: 1.9-3.7), and 13-day averages of NO2 (IQR: 0.01 ppm; β: 0.6, 95%CI: 0.2-1.0) and PM2.5 (IQR: 3.8 µg/m3; β: 0.6, 95%CI: 0.3-1.0). No associations were observed for exposures to O3, BC, and SO42-. Additional adjustment of alcohol consumption and smoking did not change the observed associations. Conclusion: We identified novel associations between short-term exposures to air pollution and higher stress rating in a cohort of elderly white men. Further investigation of the potential effects of air pollution on psychological stress, and related outcomes, in other study populations is warranted.

Abstract Number	**P-1-12-07**
Presenter	Kyung Eun Lee*, Hyung-Myung Nam, Wonwoong Na, Jae-Yeon Jang
Exposure	climate change (temperature)
Health domains	other
Type of research	case-control study

Characteristics of deaths from meteorological disasters in republic of Korea

Background Extreme weather events can cause disastrous damages among individuals or societies with poor resilience. However, epidemiological surveys have not been performed systematically after the events, so that it is rare for identifying the basic information of the deaths from meteorological disasters in Korea. Aims The aim of this study is to analyze the general characteristics and the direct causes of deaths from meteorological disasters by comparing those of the control group. Methods We used Annual Report of Causes of Deaths Statics published by Statistic Korea. Case-control study was performed involving 740 deaths from meteorological disasters and 2,960 deaths with other causes from 2000 to 2011. The 2,960 deaths of control group were randomly selected from the same data after matching the provinces and date of death. Student t-test and chi-square analysis were used to compare the differences between two groups. Results The mean age of meteorological disaster casualties was 51.64(male: 48.73, female: 56.44), which was lower than that of control groups by 15.96($p<0.001$). Every death from meteorological disasters was related with injury. On the other hand, the highest 26.4% died a malignant neoplasm-related death, and 24.9% died of cardiovascular disease in control group ($p<0.001$). While 52.8% of control group died at a medical institution, the highest 41.4% of the landslide casualties died at home. Most of the flood casualties had no place of death identified ($p<0.001$). Diverse differences between two groups in occupation and educational background were identified according to the sex and age group ($p<0.001$). Conclusions Casualties by meteorological disasters have various differences from the general deaths according to socio-demographic elements including sex, age, educational background, and vocation as well as the cause and place of death.

Abstract Number	**P-1-12-09**
Presenter	Isabella Karakis*, Dan Gandacu, Pinhas Alpert, Haim Shafir, Anat Baharad, Emilia Anis, Itamar Grotto
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	exposure modeling

Cutaneous Leishmaniasis in Israel and Correlation over Time with Average Ambient Temperature

Background: Israel is endemic for Cutaneous Leishmaniazis (CL). CL is one of the vector-borne diseases that could be affected by climate change. Few studies have examined the relationship between environmental temperature and the sand fly, and little has been published on the relation between the appearance of CL in humans and climatic changes. Aims: to examine the relationship between CL incidence and ambient temperature changes over a long-term period in different regions of the country. Methods: Epidemiology Division of the Ministry of health receives mandatory reporting information on new cases of CL. We used the data reported and processed nationally between the years 1981 - 2011 in all regions of the country. The National Meteorological Service provided access to its data file of temperatures measured every ten minutes in relevant monitoring stations. We calculated weekly moving average of the maximum and minimum temperatures. Using a statistical model, we tested lag correlation between average temperatures and reported CL incidence in the following areas: Jerusalem, Tiberias, Tel-Aviv (TA) and Beer-Sheva (BSh). Results:The maximal temperatures in BSh within 52 weeks (annual cycle) were higher than Jerusalem and TA. The maximum lag was 13 weeks in Jerusalem ($r=0.892$, 95% CI: 0.818; (0.937 and BSh ($r=0.887$, 95% CI: 0.810; 0.934). In TA max lag was 12 weeks with $r=0.89$ (95% CI: 0.815; 0.936). There was a different relationship between climate and CL incidence in the various measurement stations: in the cooler period (41st to 14th weeks) in BSh no significant correlation was found between the number of reported cases and the minimal and maximal temperature - moving lag in the annual cycle. Conclusions: After a latent period of up to 12-14 weeks following high environmental temperatures, an increase in CL incidence was observed. It is important to use this evidence to anticipate and apply preventive measures for CL spread at the optimal times of the year.

Abstract Number	**P-1-12-10**
Presenter	Wu Fang-Yang, Wu Shu-Huan*, Chou Tzu-Chieh, Sung Fung-Chang
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Effects of climate parameters in dengue fever incidence in Taiwan - retrospective observation from 1998 to 2010

Background: The epidemic patterns of dengue fever associated with climate changes in tropical and subtropical regions have attracted worldwide attention. Temperature, precipitations, relative humidity, and extreme climate events may complicate the epidemic of the disease. Transmitted by Aedes mosquitoes, the epidemic of the disease varied annually and clustered in southern part of Taiwan characterized with subtropical weather. Objective: The goal of this study was to investigate the relationship between climate factors and dengue fever epidemic in all Taiwan area. Methods: We obtained the meteorological data from the Taiwan Central Weather Bureau and used the insurance claims data to identify monthly newly diagnosed dengue fever cases from 1998 to 2010. Multivariable regression analysis was used to measure the association between incident cases of dengue fever and weather conditions in Taiwan including temperature, precipitations and humidity controlling for population density and geographical area. Results: The results showed that dengue fever incidence was positively associated with temperature, precipitations, relative humidity at lagged 1 to 5 months. The most significant associations, based on the value of r, for mean temperature ($r = 0.47$, $p < 0.01$), precipitation ($r = 0.41$, $p < 0.01$), and relative humidity ($r = -0.32$, $p < 0.001$) were found at lags of 3 months, 2 months, and 11 months, respectively. In multiple regression, precipitations and relative humidity showed the significance in whole model ($p = 0.001$ and $p = 0.009$), indicating the air water content could be a remark factor in dengue fever occurrence. Conclusion: Ultimately, we have better understanding of the relationship between climate factors and dengue fever occurrence, and humidity and rainfall could be the predictor of dengue fever occurrence in Taiwan.

Abstract Number	**P-1-12-11**
Presenter	Youn-Hee Lim, Min-Seon Park, Yoonhee Kim, Ho Kim, Keun-Young Yoo, Jin Hee Kim, Yoon-Hyeong Choi, Yun Chul Hong*
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	cross-sectional study

Effects of cold and hot temperature on dehydration: a mechanism of cardiovascular burden from extreme weather condition

Background: The association between extreme temperature, cold or heat, and cardiovascular mortality has been well documented. However, there have been few studies explaining the mechanism of cold or heat-related cardiovascular mortality or morbidity. Aims: The main goal of this study was to examine the effect of temperature on dehydration markers to explain pathophysiological disturbances caused by extreme temperature. Methods: We investigated the relationship between outdoor temperature and dehydration markers for 43,549 adults in Seoul, Korea during 1995-2008. We used piecewise linear regression to find the threshold of temperature and estimate the effects below or above the threshold. We also evaluated their association stratified by sex, age, body mass index, and hypertension. Results: Levels of dehydration markers decreased linearly with an increase in the temperature until some points between 22-25°C which are regarded as thresholds, then increased with temperature. The coefficients of temperature on BUN/Cr ratio were -0.036 and 0.083 when temperatures were below and above thresholds, respectively. The coefficients were -0.073 and 0.292 for urine specific gravity; -0.045 and 0.169 for plasma tonicity; and -0.009 and 0.038 for hematocrit. When we performed the analyses stratified by age, gender, BMI and hypertension, the associations between hydration markers and the mean temperature were largely similar among the subgroups. Conclusions: These findings suggest that dehydration increases in both cold and hot outdoor temperatures and the temperature-related change of dehydration underlie an increased cardiovascular mortality or morbidity during extreme weather conditions.

Abstract Number	**P-1-12-12**
Presenter	Daniel Oudin Åström*, Christofer Åström, Patrizia Schifano, Adele Lallo, Paola Michelozzi, Joacim Rocklöv, Bertil Forsberg
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Effects of extreme temperatures on mortality among elderly persons with chronic disease

Background: The on-going climate change is projected to increase the number, as well as the intensity, of extreme weather events. Heat waves are well known to cause significant adverse health consequences with the elderly and chronically ill among the most susceptible groups. Aim: We aim to investigate mortality during heat waves among the population above 50 as well as certain cohorts of persons with chronic disease according to health care registers in Rome, Italy and Stockholm, Sweden during the period summer period 2000-2008. We investigated the following diseases; Chronic Obstructive Pulmonary Disease (COPD); Congestive Heart Failure (CHF); Survival to Myocardial Infarction (MI); Diabetes and Psychiatric disease. Methods: For the 50+ population and our cohorts we collected daily information on the deaths occurring between 15th May and 15th September each year. We defined a heat wave as two, or more, consecutive days with temperatures exceeding the 98th percentile of daily maximum temperature. The relationship between heat waves and all-cause mortality was investigated through time series modelling, adjusting for time trends. Results: The per cent increase in mortality during heat waves as compared to normal summer days was, in the 50+ population, estimated to be 13.5% (95% CI: 7.1-20.2%) and 11.7% (95% CI: 3.8-20.1%) in Rome and Stockholm respectively. Cohort specific increase in mortality in Rome ranged from 15.3% (95% CI: -11.6-50.4%) in the Psychiatric disease cohort to 70.8% (95% CI: 16.7-149.8%) for the MI cohort. In Stockholm the range of mortality increase was from 6.0% (95% CI:-8.2-23.0%) for the CHF cohort to 25.7% (95% CI: -2.5-62.2%) for the COPD cohort. Conclusions: Mortality during heat waves increased in both Rome and Stockholm for the 50+ population as well as for our vulnerable groups. With an expected increase of elderly and other potentially vulnerable groups in society it is of importance to identify these groups in order to optimize future heat warning systems.

Abstract Number	**P-1-12-13**
Presenter	Alejandro Molina-Garcia*, Josefina Martinez-Ponce, Angeles Fuentes-Chagolla, Raymundo Puebla-Calderon, Rafael Diaz-Rodriguez
Exposure	climate change (temperature)
Health domains	costs
Type of research	health impact assessment

Estimated Costs of Diseases Related to Climate Change in Public and Private Hospitals in Michoacan State, Mexico during

Background: Human actions and activities are changing the world's climate, and are set to do so an increasing rate in coming decades. It also poses threatens our biosphere, global economy and human health and survival. Urgent actions is now required to reduce emissions of carbon dioxide (the dominant long acting greenhouse gas). Aim: To evaluate an adaptative strategy like medical hospital attention to climate change related diseases and its costs in a year. Methods: Recently, medical literature data was reviewed about climate change and related diseases in web site, books and journals. Also, local epidemiological reports were analysed and included in the climate change state strategy. Besides, public and private medical costs of every disease were investigated with recent prices in both. Results: Twenty two diseases related with climate change were found in local studies and reported according international literature. The most frequent disease in Michoacan state were asphixia and direct injuries, diaorrhea and respiratory infections. The cost of the diseases related with climate change in a day of internship is about $5,615.00 USDollars in a public hospital and $10,846.00 USDollars in a private hospital. The annual estimated cost in 25 public hospitals in Michoacan is almost $51.2 Million Dollars to attend those 22 diseases. Conclusions: The health sector should play a central role: to communicate the health risks of global heating, to collaborate with other partners, and to promote, lead and evaluate a range of adaptative strategies like this to stablish a financial cost in a hospital to attend the most vulnerable and affected population with these diseases. Urgent action at local, national and international levels is required to aid with increased financial contributions by high income countries to middle and low income countries, and free flow of information and technologies between countries about climate change concerns.

Abstract Number	**P-1-12-14**
Presenter	Peng Bi*, Alana Hansen, Monika Nitschke, Arthur Saniotis, Jill Benson, Val Smyth, Leigh Wilson, Gil-Soo Han, Yan Tan, Lillian Mwanri
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	health impact assessment

Extreme heat in Australia: are culturally and linguistically diverse communities more at risk?

Background: Several studies have identified that people in ethnic minority groups are at greater risk during heatwaves. However, there is a dearth of information on this issue in Australia despite heatwaves being a common occurrence in summer. With a highly multicultural society, it is important that vulnerable subpopulations are recognised to minimise risks of heat-related morbidity and mortality. Aims: To identify cultural, socioeconomic and linguistic factors affecting vulnerability to extreme heat in culturally and linguistically diverse (CALD) communities and to identify subgroups at risk. Methods: Interviews, focus groups and a workshop were conducted amongst stakeholders from the government sector, non-government organisations, the health sector and CALD communities in three major Australian cities. Data were analysed using thematic analysis. Results: Findings showed that people in some CALD communities struggle to cope with extreme heat in Australia where the heat can be different from that experienced elsewhere. Socioeconomic disadvantage, linguistic barriers, low quality housing, cultural factors and health issues contribute to vulnerability, particularly in humanitarian entrants. Those most at risk are older migrants and new arrivals, people in new and emerging communities, low income migrants who lack English proficiency skills, women, and infants. Conclusions: Socio-cultural barriers can place migrants and refugees at risk during extreme heat in Australia. Informing people in their language about ways to sustain health during extreme heat will assist in overcoming barriers. An outcome from this translational research has been an increase in awareness amongst policymakers of the need for equity in access to heat health messages.

Abstract Number	**P-1-12-15**
Presenter	My Svensdotter, Tom Bellander*, Gunnel Emenius, Elisabet Lindgren
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Health effects of a changing climate – impacts and adaptation needs in Stockholm County

Background: Stockholm County is one of the fastest growing regions in Northern Europe (by >1% inh/y), and has an increasing elderly population, a building tradition to retain heat, surface waters used as tap water, and a high incidence of tick-borne diseases. These factors all potentially increase the vulnerability to health impacts of climate change. Aim: To assess health effects due to climate change in Stockholm County 2012-2100, and identify adaptation measures. Method: A risk assessment based on local climate scenarios for Stockholm County until 2100, (A1B by the Rossby Centre), and a regional societal analysis of vulnerability based on demographics, disease prevalence, and land use. Results: Cold-related mortality will decrease, whereas mortality and cardiorespiratory morbidity related to heat will increase, primarily due to high indoor temperatures during summer. The proportion at risk of the current population is estimated at about 15.4%: 6.6% age-related (>75 y) and 8.8% related to cardiovascular disease (<75 y). Population at high risk is 3.7% (>75y and CVD). All these proportions are expected to increase. Flooding and changes in water flows increase the risk of contaminated waters used for drinking, irrigation and recreational purposes. Vibrio (non-cholera) and harmful algal blooms will increase with higher temperatures in the Baltic Sea. Shifts in seasons will affect pollen-related allergies. The risk season for Lyme borreliosis and tick-borne encephalitis will increase by 4 months. Sand flies transmitting Leishmaniasis may become established by 2100. Identified adaptation measures include education of health care staff, monitoring of risk groups, green space adaptation and passive cooling systems. Conclusion: Climate change is likely to increase the health burden in Stockholm County, particularly heat-related effects and infectious diseases. Measures to prepare the health care system, as well as physical adaptation in the regional planning are needed.

Abstract Number	**P-1-12-16**
Presenter	Tine Fierens, Arnout Standaert, Mirja Van Holderbeke, Luc Int Panis*
Exposure	climate change (temperature)
Health domains	other
Type of research	exposure modeling

Impact of climate change on human dietary exposure to heavy metals in the Netherlands

Background and Aims The main goal of 'Climate Cascades' is to assess the potential impact of changes in toxic substances and waterborne pathogens resulting from the effects of climate change on soil, groundwater and surface water at the river basin scale, on man and terrestrial and aquatic ecosystems. In the course of this project, the impact of climate change on a.o. human dietary exposure to heavy metals for selected case study areas in the Netherlands will be investigated. Climate change is likely to affect fate and transport of heavy metals in the environment. Effects may be very different for the environmental compartments considered. Changes in meteorological conditions can, e.g., cause soil acidification and alterations of organic matter decomposition which, in turn, affects the mobilization of metals in the soil and their availability. Until now, little information is available about the impact of climate change on the environmental distribution of heavy metals and their potential effects on man and ecosystems. Moreover, the absence of health indicators is a serious blind spot in the climate change discussion. There is a need for appropriate methods to conceptualize the full chain of events leading to potential health effects. Climate Cascades wants to meet all these lacks. Methods and Results In the project, a number of relevant climate change scenarios will be defined. Model simulations based on these scenarios will reveal the changing dynamics and shifts in the distribution of heavy metals in environmental compartments and provide quantitative estimates of the impact of these changes on human health via the food chain. Two human exposure models, S-Risk and XtraFood, will be adapted to assess human exposure to heavy metals via food consumption under these scenarios of changing climatic conditions. Conclusions With the results obtained in Climate Cascades, potential impacts of heavy metals in relation to climate change and human dietary exposure will be evaluated.

Abstract Number	**P-1-12-17**
Presenter	Yan Bi, Weiwei Yu*, Wenbiao Hu, Hualiang Lin, Yuming Guo, Zhiwei Xu, Shilu Tong
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Impact of climate variability on Plasmodium vivax and Plasmodium falciparum malaria in the high risk area of Yunnan Province, China

Background: Malaria remains a public health problem in the remote and poor area of Yunnan Province, China. Yunnan faces an increasing risk of imported malaria infections from Mekong-River neighboring countries. Aims: This study aimed to identify the high risk area of malaria transmission in Yunnan Province, and to estimate the effects of climatic variability on the transmission of Plasmodium vivax and Plasmodium falciparum in the identified area. Methods: We identified spatial clusters of malaria cases using spatial cluster analysis at a county level in Yunnan Province, during 2005-2010, and estimated the weekly effects of climatic factors on P.vivax and P.falciparum based on a dataset of daily malaria cases and climatic variables. A distributed lag nonlinear model (DLNM) was used to estimate the impact of temperature, relative humidity and rainfall on both types of malaria parasite up to 10-week lags. Results: The results show that the primary cluster area was identified in western Yunnan along China-Myanmar border. The relative risk (RR) in malaria caseswith a 1 °C increase in minimum temperature was statistically significant from lag 4 to lag 9 weeks with the highest RRs of 1.03 (95% CI, 1.01, 1.05) for P.vivax at a 7 week lag and1.07 (95% CI, 1.04, 1.11) for P.falciparum at a 6-week lag; the RR with a 10-mm increment in rainfall was statistically significant from lag 2 to lag 4 weeks and from lag 9 to lag 10 weeks with the highest RRs of1.03 (95% CI, 1.01, 1.05) forP.vivax at a 2-week lag and 1.04 (95% CI, 1.01, 1.06) for P.falciparum at a lag of 2 weeks; and the RR with a 10% rise in relative humidity was statistically significant from lag 3 to lag 8 weeks with the highest RRs of 1.24 (95% CI: 1.10, 1.41) for P.vivax at a 5-week lag. Conclusions: Our findings suggest that the China-Myanmar border is a high risk area for malaria transmission. Climatic factors appeared to be major determinants for malaria transmission in this area. The estimated lag effects for these factors and malaria are consistent with the life cycle of malaria parasite.

Abstract Number	**P-1-12-18**
Presenter	Stefan Zacharias*, Christina Koppe, Hans-Guido Mücke
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	others

Influence of climate change on biotropic weather effects and human health in Germany

Biometeorological studies have clearly shown the influence of specific weather patterns (in particular distinct weather changes) on human health and on physical and mental disorders in sensitive individuals. Climate change may lead to even more distinct and rapid weather changes, which could contribute to an enhanced biotropic exposure of the human organism. In the framework of the German Adaption Strategy to climate change, the project “Climate change, bioclimatology and health effects” (funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) aims at, firstly, bringing together the actual knowledge about weather sensitivity and weather-related diseases and, secondly, studying the influence of climate change on weather effects regarding human health. To reach the first goal, a systematic literature review on the influence of meteorological parameters on human health was performed. Different data bases were searched for ongoing research of the last ten years (2002-2012) and more than 600 peer-reviewed articles were evaluated. The literature survey demonstrates that the influence of weather conditions on many diseases is well documented. Empirical evidence and proven mechanisms exist for both direct and indirect effects. Overall, the most important meteorological factor is the thermal environment. Extreme temperatures and rapid temperature changes enhance the prevalence and mortality of many diseases. To a minor degree, parameters such as pressure, humidity, and sunshine duration also exert unfavourable effects on human health. To assess future changes of meteorological parameters and of the frequency of biotropic weather regimes in Germany, simulations of regional climate models are evaluated. Preliminary results indicate that a future climate is characterised not only by less cold and more hot days, but also by stronger day-to-day fluctuations of temperature und air pressure, which points to intensified biotropic weather effects.

Abstract Number	**P-1-12-19**
Presenter	Hyun-joo Bae*, YongSeong Shin, Jeong-Gyu Park, Haeyoung Pak
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	time series study

INTERACTIVE EFFECTS BETEEN OZONE AND TEMPERATURE ON RESPIRATORY ADMISSIONS IN KOREA

Background and Aims: Many studies have reported that ozone is associated with mortality and morbidity. A few epidemiological studies have examined the interactive effects between ozone and temperature on mortality and morbidity. In this study, we aimed to evaluate the potential modifying effect of the temperature when analyzing the health effects of ozone in South Korea. Methods This present study used time-series analysis to investigate the association between risk of respiratory admission and ozone in Seoul, Busan, and Daegeon, during June to August, 2003-2010. In order to examine the interactive effect between ozone and temperature on respiratory admissions, we fitted a response surface model adjusting for the confounders. We separately fitted the stratification model to quantitatively estimate the association between ozone and respiratory admissions across different temperature levels. Results When temperature was high (above the threshold temperature), for a 10ppb increase in ozone concentration, the contributions of respiratory hospital admissions in all ages population were 0.04% (95% confidence interval [CI]: -0.01~0.10%), 2.73% (95% CI: 0.73~4.68%), and 2.85% (95% CI: 0.75~4.91%) in Seoul, Busan, and Daegeon, respectively. When temperature was low (under the threshold temperature), for a 10ppb increase in ozone concentration, the contributions of respiratory hospital admissions in all ages population were -0.02% (95% CI: -0.08~0.04%), 1.25% (95% CI: 0.09~2.41%), and 2.39% (95% CI: 0.77~4.02%) in Seoul, Busan, and Daegeon, respectively. Conclusions We concluded that temperature synergistically modified the ozone- respiratory admissions association in Busan region, but such a pattern was not apparent in Seoul region. The results suggest that both temperature and geographic factors should be considered in the assessment of ozone effects.

Abstract Number	**P-1-12-20**
Presenter	Simon Lloyd*, Sari Kovats, Zaid Chalabi, Sally Brown, Robert Nicholls
Exposure	others
Health domains	other
Type of research	health impact assessment

Modelling the influences of climate change and socioeconomic development on future storm surge mortality

Background:Over recent decades, vulnerability to coastal flooding has decreased but remains disproportionately high in low-income countries. In the future, climate change is expected to increase disaster risk, potentially reversing this trend. Aims: We developed a statistically-based model for estimating future storm surge mortality across the globe. Methods:We fit the model using mortality data from a disaster events database. We estimated surge-attributable mortality and split the data into a short and long time-series to give a more robust fit. The model accounts for sea-level rise using input from the DIVA coastal flood model and socioeconomic change using the Human Development Index (HDI), allowing for an initial increase in risk as low-income countries develop (consistent with observations). Health impact projections were made under an A1b scenario, with and without adaptation. We quantified the error in the final mortality estimates arising from uncertainties in the surge exposure estimates. Results:The model had a good statistical (R2=0.43) and theoretical fit. Validation suggested the model predicts log risk well (R=0.67); we projected the relation between log risk, socioeconomic change, and surge exposure for selected countries. For mortality, however, validation suggested predictive power is very low: thus we show future mortality categorically. The results suggest climate change will increase mortality in most regions but that impacts may be significantly reduced by adaptation. Uncertainty is greatest in futures with climate change but without adaptation. Conclusions:Risk tends to change continuously over time and appears to be well predicted by the model. Mortality is subject to discontinuities associated with large events and is less amendable to continuous statistical modeling. Despite the limitations of the model itself, we made methodological advances in terms of the use of disaster data (use of a long time-series; separation of surge-specific deaths) and representing socioeconomic change (HDI; benefits and harms of development).

Abstract Number	**P-1-12-21**
Presenter	Michela Leone*, Francesca de Donato, Klea Katsouyanni, Timo Lanki, Daniel Oudin Åström, Carmen Iñiguez, Xavier Basagaña, Matteo Scortichini, Anna Páldy, Paola Michelozzi
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

PHASE EU-project. Variations in the high temperature - mortality relationship and the harvesting effect in 8 European cities

Background: After 2003 great attention has been paid to the health effect of heat in Europe, however to date a multicity study on the variation in the heat effects at the European level possibly associated to adaptation measures introduced, has not been carried out. Aim: The study aims to evaluate whether there is a change in the effect of high temperatures on mortality in European cities in two study periods, before (1996-2002) and after (2004-2010) 2003. Changes in the effect by age, cardiovascular and respiratory causes as well as variations in harvesting effect are investigated. Methods: We analyzed daily total mortality in 8 European cities (Athens, Barcelona, Budapest, Helsinki, Paris, Rome, Stockholm, Valencia) and maximum apparent temperature (tappmax) was defined as exposure. We performed city-specific analyses using distributed lag non-linear models. Analysis was restricted to summer season (June-August). The relative risk in mortality at lag 0-3 was expressed at 90th percentile compared to 50th percentile. To investigate the harvesting effect, a lag structure up to 40 days was considered. Results: Results show that even if summer temperatures have increased in all cities in recent years (2004-2010) the effect is reduced in most cities, with the highest reduction in Athens and Rome (-12% and -7%, respectively). In Stockholm, Helsinki the effect was greater (+8% and +3%, respectively). The harvesting effect was different in the two periods and among cities; Budapest, Stockholm and Barcelona a harvesting effect was observed in both periods, in Helsinki and Paris the effect was observed only in the second period while in Athens and Rome no harvesting effect was observed in recent years. Conclusions: The reduction in the effect on mortality observed in most cities and the heterogeneous harvesting effect are important findings when we considering future climate change and the role of heat adaptation measures.

Abstract Number	**P-1-12-22**
Presenter	Kai Chen*, Jun Bi, Tiantian Li, Xiuzhen Zhang, Lei Huang
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	health impact assessment

Spatial analysis of the 2010 heat wave on stroke mortality in Nanjing, China

Background Heat waves have devastating health effects on human populations. Our previous study shows that heat waves had a higher risk for stroke mortality in Nanjing. Despite many studies of mortality risk for heat waves in urban areas, few studies have examined the spatial variations among different regions. Objectives We analyzed the stroke mortality of a heat wave in 2010 in Nanjing, China and investigated the spatial variability of stroke mortality risk between heat wave days and non-heat wave days. Methods Within each town of Nanjing, we calculated the stroke mortality during the heat wave (July 30–August 22, 2010) and a reference period (July 30-August 22, 2009). We estimated the rate ratios (RRs) of urban, suburban, and rural regions. Spatial autocorrelation was used to measure the spatial patterns of heat wave mortality. The Anselin Local Moran's I statistic was applied to identify the statistically significant spatial clusters. Results Stroke mortality in both the heat wave and the reference period were spatially clustered, with the Moran’s Index of 0.147 and 0.089. During the reference period, two HH spots(areas with high stroke mortality surrounded by other areas with high stroke mortality) were found in rural regions and the clusters in urban and suburban regions were not significant. During the heat wave, the two hot spots in rural regions remained while an HL spot(areas with high mortality surrounded by other areas with low mortality) was discovered in the suburban region. During the heat wave, the RRs of stroke mortality were 2.25(95%CI,1.03-4.27) in the urban area, 4.14(95%CI,2.77-5.95) in the suburban area, and 1.66(95%CI,1.33-2.05) in the rural area. Conclusions We found that stroke mortality risk from heat waves in Nanjing has clear spatial patterns. During the heat wave, suburban regions have the highest and spatially clustered stroke mortality risk. These findings revealed the importance of the health impact of heat waves in suburban areas.

Abstract Number	**P-1-12-23**
Presenter	Yoonhee Kim*, Ho Kim, Yasushi Honda, Yue-Liang Guo, Bing-Yu Chen, Youn-Hee Lim, Na-Kyung Kim
Exposure	climate change (temperature)
Health domains	mental health
Type of research	case-crossover study

Suicide and Ambient temperature in East Asia

Background and Aims: Seasonality of suicide with a peak in spring and early summer has been observed all over the world. Some studies reported that ambient temperature contributed to the suicide, but it still remained the mixed evidences. The purpose of this study is to evaluate association between ambient temperature and suicide in fifteen cities of South Korea, Japan, and Taiwan. Methods: Time-stratified case-crossover method with fifty-six days strata was used to explore the relationship between daily mean temperature and daily suicide counts, controlling for relative humidity, atmospheric pressure, linear long-term trend, and month.. Also, the cases and controls were matched by day of the week within each stratum. To estimate the differences of gender and age group, we used the interactions between temperature and these time invariant variables (gender or age) in the model. Age group was categorized into three groups such as age 10 and 24, age 25 and 64, and the elderly (age 65 and over). Results: In most cities high temperature significantly increased suicide, except three cities. The largest odds ratio (OR) of suicide was 1.067 (95% CI= 1.029-1.106) corresponding to 10% increase in daily mean temperature in Daejeon of Korea, while the smallest OR was 1.016 (95% CI= 0.995-1.037) in Nagoya of Japan. Depending on the countries, the ORs in Taiwan were increased toward the south, while the temperature effects on suicide of Korea and Japan varied from city to city. Also, we observed that the temperature effects of male and the elderly suicide were mostly higher than others, based on the gender- and age- specific ORs. Meanwhile, the temperature effect on the elderly suicide was higher than other two groups in some cities, whereas the gender difference was not observed all fifteen cities. Conclusions: The results of temperature-related suicide are likely to be able to provide another important consideration for the suicide prevention programs.

Abstract Number	**P-1-12-24**
Presenter	Antonis Analitis*, Francesca de Donato, Michela Leone, Paola Michelozzi, Bertil Forsberg, Ana M. Vicedo-Cabrera, Raimo O Salonen, János Bobvos, Klea Katsouyanni
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Synergy in the effects of temperature and air pollution on mortality in 8 European cities. Results from the PHASE project.

Background: Numerous studies have associated excess heat or cold with increased mortality. Air pollution, especially particulate matter and ozone also deteriorate human health. Their joint effects, though, are less well studied and understood. Aim: Within the PHASE project, we used data from 8 European cities (Athens, Barcelona, Budapest, Helsinki, Paris, Rome, Stockholm and Valencia) to investigate possible synergistic effects of temperature and air pollution on mortality. Methods: City-specific Poisson regression models controlling for seasonality and other confounders were used separately for summer (April-September) and winter (October-March). Maximum apparent temperature was the exposure variable in summer, while minimum was used in winter. Based on previous results, threshold terms for summer and linear temperature terms for winter were used. Interaction terms between temperature and pollution variables were included in the models to investigate synergy on all cause, cardiovascular and respiratory mortality, in all ages and by age group. Results: Initial results provide evidence for synergy in several participating cities. For example, significant positive interaction between high temperature and PM10 was found in Athens and Paris, concerning both total and cardiovascular mortality in all ages. In Athens, significant synergy was also detected between high temperature and ozone on cardiovascular mortality in all ages. In Paris and Stockholm, a significant positive interaction between high temperature and ozone was found on total mortality in all ages. Conclusions: There is evidence for higher impact on mortality on days with both high temperature and high ozone or PM10 concentration, although this was not consistent across all cities. These findings should have implications on policy-making in Europe.

Abstract Number	**P-1-12-25**
Presenter	María-Guadalupe Garibay-Chávez*, Arturo Curiel Ballesteros, Tania Parada
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	health impact assessment

Temperature and ischemic heart disease mortality in cities of tropical, Mexico

Background The temperature in the Guadalajara Metropolitan Area (GMA, the second-largest in Mexico) has increased from 22 degrees (1996-2000) to 26oC (1996-2009); 2005 was a critical year with respect to temperature increase, ischemic heart disease mortality was the second cause of death in the GMA. Aims To analyze the relation between an increase in temperature and ischemic heart disease mortality in GMA during 2005. Methodology Observational, retrospective and longitudinal study of the year 2005. The maximum observed daily temperature and daily ischemic heart disease mortality were analyzed. Days on which temperatures were equal to or above 32oC were identified. Daily ischemic heart disease mortality was analyzed with respect to the relation between the maximum observed daily temperature on such days or on the days following the temperature increase. Temperature data was obtained from the GMA Automatic Atmospheric Monitoring Network and information related to daily mortality was obtained from Jalisco's Public Health Department (SSJ). Results In the GMA, during 2005, the highest number of days (124) with temperatures equal or above 32oC was recorded. Seventy-percent occurred during April to June. During the 124 days, there were 305 deaths due to ischemic heart disease, 53.4% of such deaths occurred when the temperature range was 33 to 36 oC, concentrated (72.4%) during the months from April to June. With respect to the increase in the number of deaths, it was found that on days after exposure to such temperatures, there was an increase of 22 deaths three days after exposure.No signifficant differences between groups. Conclusions In 2005, 32.51% of deaths due to ischemic heart disease occur when temperatures are equal or above 32.4oC. It was also observed that ischemic heart disease mortality is high in zones which historically register higher maximum temperatures, at a rate of 4.19/10,000 inhabitants.

Abstract Number	**P-1-12-26**
Presenter	Avalos Lyndsay, Hong Chen, De-Kun Li, Rupa Basu*
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	case-crossover study

Temperature and risk for preterm delivery in Northern California

Background: Heat waves are likely to increase in severity and duration in the future. Few studies have been conducted to examine the effect of temperature on adverse birth outcomes. Aim: This study assesses the relationship between apparent temperature, a combination of heat and humidity, and preterm delivery (PTD). Methods: We conducted a time-stratified case-crossover analysis using data from Kaiser Permanente Northern California (KPNC) women who had a PTD identified by KPNC electronic medical records. 16,635 PTDs were identified between January 1, 1999 and December 31, 2009. These data were combined with meteorologic monitoring data based on residential zip codes that had monitors within 20 kilometers. Results: Preliminary analyses suggest a relationship between high apparent temperature and PTD. A 3.98% increase (95% CI: 0.90%, 6.95%) in PTD was associated with every 10°F increase in weekly average (lag06) apparent temperature. Season (warm vs. cold) and sub-type of preterm delivery (length of gestation) modified these findings. An elevated relationship emerged in the warm season, with a 6.95% increase (95% CI: 2.00%, 11.86%) in PTD associated with every 10°F increase in weekly average apparent temperature compared to 1.0% (95% CI: -4.01%, 4.98%) in the cold season. Pregnancies between 35-36 gestational weeks in the warm season were at the highest risk with a 9.9% increase (95%CI: 3.98%, 16.71%) in PTD associated with every 10°F increase in weekly average apparent temperature compared to 3.98% (95%CI: -5.03%, 9.90%) for <35 gestational weeks and -5.03% (95% CI:-26.70%,17.68%) for 37 gestational weeks. Conclusions: These findings suggest interventions associated with heat waves and climate change should target pregnant women.

Abstract Number	**P-1-12-27**
Presenter	Chisato Imai*, W. Abdullah Brooks, Doli Goswami, Bilkis Ara Anjali, Ashraf Dewan, Yeonseung Chung, Ho Kim, Masahiro Hashizume
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

The association between weather variability and Influenza incidence among young children in a low-income urban population in Bangladesh.

Background: While influenza outbreaks are generally linked to dry and cold weather in temperate regions, the cases in tropical regions are often detectable throughout the year with one or two epidemics during rainy seasons. Some studies speculate that such phenomenon may attribute to the different dynamics of transmission. However, the reason remains largely uncertain since the influenza seasonality in tropical regions is poorly understood and not as well documented as in temperate regions. Aims: This study is to assess whether the influenza incidence is associated with humidity, temperature, precipitation, and sunlight duration among young children in a low-income urban population in Bangladesh. Methods: Acute respiratory illness (ARI) data was obtained from a population-based clinic surveillance system in Kamalapur, an urban slum area of Dhaka, Bangladesh. Analyzed data was from January 1, 2005 to December 31, 2008. Nasopharyngeal wash (NPW) specimens were collected from approximately every fifth clinic visit (20%) to identify influenza virus infection with viral culture and reverse transcriptase-polymerase chain reaction (RT-PCR). Time series analysis was conducted to determine the association between the number of influenza cases per week and meteorological factors. Zero-inflated model was used in this analysis to take into account of excessive zero cases. Subgroup analysis was also conducted to further illustrate how potential effect modifiers, such as the number of family members and rooms, are associated with influenza cases. Result: The total 14,140 visits for ARI were observed at the surveillance clinic during the study period, of which 3,198 NPWs were collected and 578 cases were identified infections with influenza virus. In Kamalapur, one distinctive epidemic was observed every year concomitantly with rainy season - which is May through September. The results of associations between meteorological factors and influenza cases, and subgroup analysis will be explored. Conclusion: Will be presented in conference.

Abstract Number	**P-1-12-28**
Presenter	Attila Trájer*, Ákos Bede-Fazekas, János Bobvos, Anna Páldy
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	exposure modeling

THE EFFECT OF CLIMATE CHANGE ON THE POTENTIAL DISTRIBUTION OF THE EUROPEAN PHLEBOTOMUS SPECIES AND THE PARASITE LEISHMANIA INFANTUM IN 2011-2070. A CLIMATE ENVE

Background/Aims: In the Mediterranean areas of Europe, leishmanisasis is one of the most emerging vector-borne diseases. Members of genus Phlebotomus are the primary vectors of the genus Leishmania. To track the human health effect of climate change it is a very important interdisciplinary question to study whether the climatic requirements and geographical distribution of the vectors of human pathogen organisms correlate with each other. Our study intended to explore the potential effects of ongoing climate change, in particular through a potential upward altitudinal and latitudinal shift of the distribution of the parasite Leishmania infantum, its vectors Phlebotomus ariasi, P. neglectus, P. perfiliewi, P. perniciosus, and P. tobbi, and some other sandfly species: P. papatasi, P. sergenti, and P. similis. Methods: By using a climate envelope modelling (CEM) method we modelled the current and future (2011-2070) potential distribution of 8 European sandfly species and L. infantum based on the current distribution using the REMO regional climate model. Results: We found that by the end of the 2060's most parts of Western Europe can be colonized by sandfly species, mostly by P. ariasi and P. pernicosus. P. ariasi showed the greatest potential northward expansion. For all the studied vectors of L. infantum the entire Mediterranean Basin and South-Eastern Europe seemed to be suitable. L. infantum can affect the Eastern Mediterranean, without notable northward expansion. Our model resulted 1 to 2 months prolongation of the potentially active period of P. neglectus P. papatasi and P. perniciosus for the 2060's in Southern Hungary. Conclusion: Our findings confirm the concerns that leishmanisais can become a real hazard for the major part of the European population to the end of the 21th century and the Carpathian Basin is a particularly vulnerable area.

Abstract Number	**P-1-12-29**
Presenter	Noah Scovronick*, Paul Wilkinson
Exposure	food
Health domains	other
Type of research	health impact assessment

The impact of biofuel-induced food-price inflation on food demand and dietary greenhouse gas emissions

Background: Liquid biofuel production has increased dramatically in recent years and is expected to continue. This growth has led to concerns about the impact of biofuel production on food prices, which may show significant biofuel-related inflation. In consequence,biofuels may influence food intake and greenhouse gas (GHG) emissions through its effect on food prices and associated food demand. Aims: We estimated changes to energy (calorie) demand and embodied GHG emissions in average diets under different biofuel-related food-price scenarios for three countries: Brazil, China and the USA. Methods: We used published food-price projections, food-price elasticities and food demand data to predict dietary change under the different price scenarios. Estimates of embodied emissions in foods were taken from multiple studies in the literature. Uncertainty was explored with Monte Carlo simulations. Results: Average energy demand decreased in all countries, from about 40 kcal per person per day in Brazil under a moderate price inflation scenario – a reduction of 1% relative to the (2009) reference scenario - to over 300 per day in the USA with high price inflation – about 8% of reference levels. In terms of GHG emissions, the results are suggestive of reductions only in the USA, where average reductions ranged from 30-80 kg/CO2e/person/year. In China, the direction of impact is unclear, but the net change is likely to be minimal. Brazilian results were sensitive to parameter values and the direction and magnitude of impact is therefore uncertain. Conclusions: Our results demonstrate that biofuel-induced food-price inflation is likely to influence the quantity and composition of future diets. These changes will affect dietary GHG emissions and have important implications for public health. Reduced energy intake in food-insecure populations may result in higher levels of undernutrition, whereas it could benefit populations suffering from overnutrition.

Abstract Number	**P-1-12-30**
Presenter	Jinseob Kim*, Hae-Kwan Cheong, Ho Kim, Yasushi Honda, Mina Ha, Hashizume Masahiro, Kasis Inape
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	time series study

The Impact of Local and Oceanic Climate Variability on the Incidence of Childhood Pneumonia in Papua New Guinea

Background: Childhood pneumonia is common in tropical regions, and a number of studies have associated pneumonia risk with climate and other factors. However, the findings have often been contradictory and unconvincing. The aim of this study was to evaluate quantitatively the association between geographic and climate factors on the incidence of childhood pneumonia in Papua New Guinea (PNG). Aims: To quantitatively evaluate the association between geographic and local and regional climate factors on the incidence of childhood pneumonia in Papua New Guinea (PNG). Methods: Based on the National Health Information System and the National Weather Service data in PNG, pneumonia incidence under 5-year-olds and the meteorological factors were obtained from six areas, including monthly rainfall (mm), monthly mean of the daily maximum temperatures (℃) of the period of 1997-2006. As regional climate factors, the southern oscillation index (SOI) and the dipole mode index (DMI) were used to explicate the oceanic oscillations. After testing linearity of effects of the climate variables using a generalized additive model, a generalized linear model was constructed to measure the effect size of each climate factor. Pooled effects of the climate variables among 6 sub-areas of PNG were estimated using meta-analysis. Results: Pooled risk per every 10 mm increase of rainfall is 0.24% and that of risk per every 1℃ increase of the monthly mean of the maximum daily temperatures is 4.88%. SOI and DMI showed overall negative effect on childhood pneumonia incidence (-0.57%, -4.3%, respectively) and the dry season had a higher risk of pneumonia compared to the rainy season (Pooled: 12.08%). Conclusions: We verified the relationships between local and regional climate factors and risk of childhood pneumonia in PNG, and also found that the effect size can be different according to geographic features and local climate variables. Evaluation of health effect based on local and regional climate factors reflect the impact of local health determinants.

Abstract Number	**P-1-12-31**
Presenter	James Milner*, Ian Hamilton, Michael Davies, Paul Wilkinson
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	exposure modeling

The potential for increased winter indoor temperatures due to retrofitting homes in England

Background: Cold housing is thought to contribute to excess winter mortality and morbidity. Given the projected intensification of action to increase home energy efficiency in high income settings, we assessed the potential to improve winter indoor temperatures and maximize benefits to health from targeted interventions. Aims: To estimate indoor winter temperatures in English dwellings and the potential increases relevant to health that could be achieved through home energy efficiency interventions. Methods: Indoor winter temperatures were estimated using dwelling and energy efficiency characteristics from the English Housing Survey. Temperature increases due to different energy efficiency interventions were modelled using empirical evidence, taking account of eligibility. Results: 26.5 million people in England (including 5.7 million under 16 years and 1.5 million over 75 years) live in homes with predicted indoor temperatures < 18 °C, and 45,000 people (11,000 children, 2,000 elderly) in homes with predicted temperatures < 15 °C when the outdoor temperature is 5 °C or less. These indoor temperatures are sufficiently low to have adverse effects on cardio-respiratory health and mental well-being. Differences between population groups were found in relation to the characteristics of their homes. Installing all straightforward energy efficiency interventions (including roof and wall insulation, double glazing, and heating system replacement) increased predicted indoor temperatures by 0.6 °C on average and up to 6.5 °C in some homes. However, the associated energy savings were relatively modest and some dwellings still did not maintain an adequate temperature even after retrofitting. Conclusions: Although conventional energy efficiency measures have potential to increase indoor temperatures with benefit for health, especially for vulnerable groups, much more ambitious and expensive energy efficiency interventions are needed to meet health and energy reduction goals.

Abstract Number	**P-1-12-32**
Presenter	Carlos Lopez*, Valentina Davydova
Exposure	climate change (temperature)
Health domains	healthrelated quality of life
Type of research	exposure measurement

Tourism Climate Index in Puerto Vallarta as a useful tool in the prevention of diseases related to climate.

Background: The tourism climate index(TCI) Mieczkowski (1985), is a useful tool that is used today to meet the climatic conditions in various tourist destinations, where seven climate variables come together to get the index. Objectives : Assess the TCI as a tool for preventing climate related diseases Methods: It study was conducted in Puerto Vallarta Jalisco Mexico, and were assessed 10 years (2002-2012), for which variables were obtained as: average and maximum temperature, relative and minimum humidity, wind speed, precipitation and daylight hours. In addition to characterizing the months with the highest number of dengue cases. Results: The months that were more favorable to visit Puerto Vallarta were: November, December, January and February. Unlike June, July, August, September who were disadvantaged mainly by rain, some of this precipitation caused by tropical cyclones, these months coincide with the highest number of dengue cases. Conclusions: The TCI is a useful tool for the prevention of which there is a greater amount of weather-related diseases. Keywords: tourism climate index, Puerto Vallarta, precipitation, humidity, wind.

Abstract Number	**P-1-12-33**
Presenter	Francesco Nordio*, Francesco Nordio, Antonella Zanobetti, Itai Kloog, Joel D. Schwartz
Exposure	climate change (temperature)
Health domains	other
Type of research	meta-analysis

Using meta-smoothing to estimate exposure-response curve between ambient temperature and mortality: a multi-city time series analysis.

Background: The shape of non-linear relationship between temperature and mortality varies between different cities with different climatic conditions. Moreover, there has been little examination of how these curves change over time. Aims: Our aim is to evaluate the short-term effects of temperature on mortality in 211 US cities between 1962 and 2006, which have been grouped in clusters. Method: Cluster analysis has been used to group the cities consistent with levels of temperature and relative humidity. Within each cluster we applied city--specific Poisson models, controlling for long-term trend, seasonality and day of the week. The exposure–response functions were estimated on the day of death (lag 0), as well as the mean temperature of the 5 preceding days (lag 1-5) using B-splines. The study-specific estimates are then combined through meta-smoothing. We ran the analysis for each decade to evaluate how the association changes over time within each cluster. Results: We identified eight clusters characterized by cold winters (Clusters 1,2) as in the north-west or mild ones as in the south-east (Clusters 5,8). Similarly, we identified clusters characterized by hot and humid summer in south-west and Gulf of Mexico (Clusters 4,6,7) or humid continental and semi-arid in the center of US (Cluster 3). At lag 0 we captured different magnitude of heat effects: at 30°C vs -10°C we found in Cluster 3 a RR of 1.16 (1.14-1.19), and in Cluster 5 a RR of 1.28 (1.21-1.35). Lag 1-5 captured the cold effect: at 0°C vs 20°C in Cluster 1 the RR was 1.15 (1.14-1.16) and in Cluster 6 the RR was 1.22 (1.19-1.25). The analysis of decades showed a high mortality risk for hot temperatures between 1962 and 1979 compared to the other years suggesting the effect of air conditioning in the most recent years. There was no consistent pattern of heat risk change after 1980. Conclusions: The modeling strategy for non-linear effects adopted allowed us to identify and stabilize the risks of climate change over time and in different climatic zones of the US.

Abstract Number	**P-1-13-01**
Presenter	Jung Ah Kim*, Su Ryeon Noh, Yong Jin Jeon, Hyun Sook Bae, Gwi Heum Eom, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	metals
Health domains	other
Type of research	cohort study

A Follow-up Study on the Concentration Change of Heavy Metals in Urine of Residents 3 Years After the Hebei Spirit Oil Spill

Background: In the baseline study, which was conducted 1.5 years after the Hebei Spirit oil spill, we found a significant relationship between the levels of heavy metals and exposure to the oil spill (including clean-up activities and distance from their homes to the spillage site). Aims: We performed an analysis of urinary cadmium and urinary mercury of residents 3 years after the oil spill exposure to assess changes or recovery in levels of heavy metals. Methods: The participants of the study were 270 residents who were highly exposed to the oil spill, and they all participated in both the baseline and the follow-up survey. Results: Even 3 years after the oil spill, the levels of cadmium were significantly associated with the total days of clean-up work after the oil spill. The levels of mercury were significantly related to the distance from the incident site to their residences. As time passed, the concentration of cadmium decreased; however, the mercury levels increased. Conclusions: As the existing levels of heavy metals in residents who were heavily affected by the accident relates to the Hebei Spirit oil spill exposure, we need to continuously investigate and follow up on their health.

Abstract Number	**P-1-13-02**
Presenter	Jicheng Gong*, Junfeng Zhang, Tong Zhu, Howard Kipen, Guangfa Wang, Min Hu, Pamela Ohman-Strickland, shou-En Lu, David Q Rich, Wei Huang, Wanting Lin
Exposure	biomarker
Health domains	other
Type of research	cohort study

Associations of Urinary Amino-PAHs With Ambient Air Pollutants in Beijing Residents

Background: Certain nitro-polycyclic aromatic hydrocarbons (nitro-PAHs) are specifically emitted from internal engines especially diesel engines. Nitro-PAHs can be metabolized into amino-PAHs that are excreted in urine. Therefore, urinary amino-PAHs may serve as internal dose markers of traffic emissions. Aims: The present study is to examine whether the traffic restriction implemented during the Beijing Olympics would lead to reductions in urinary amino-PAHs in Beijing residents. It is also to examine whether amino-PAHs would be associated with traffic-related pollutants measured 1 to 7 days prior to urine collection Methods: Urine samples of 125 healthy and non-smoking subjects were collected before, during, and after the Olympics. PM2.5, EC, CO, NO2, particle number concentrations, and particulate-bound PAHs, were measured throughout the study period. Sum of 1- and 2-Amino-naphthalene and 1-amino-pyrene were measured using an HPLC-fluorescence method. The association between each urinary metabolite and each air pollutant was analyzed using a linear mixed model. Results: The concentrations of each urinary metabolite decreased from the pre- to during-Olympic period, and the decreases in 1&2-Amino-naphthalene were statistically significant. Concentrations of 1&2-amino-naphthalene were consistently and significantly associated with each of PM2.5, EC, NO2, CO, pyrene and benzo(a)pyrine at lag 2. 1-Amino-pyrene was significantly associated with PM2.5, pyrene, and benzo(a)pyrene at lag 1 or 2. Each urinary metabolite was significantly associated with the particle number concentrations at lag 2. Conclusions: Urinary 1&2-Amino-naphthalene and 1-Amino-pyrene may serve as internal dose markers of short-term exposures to traffic-emitted pollutants in urban residents.

Abstract Number	**P-1-13-03**
Presenter	Lena Novack, Ester Manor, Elena Gurevich, Maayan Yitshak-Sade, Daniella Landau, Batia Sarov, Reli Hershkovitz, Tali Vodonos, Isabella Karakis*
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	cross-sectional study

Cell Proliferation of umbilical cord blood cells as a sub-clinical endpoint in relation to environmental exposures: biomonitoring pilot study in Southern Israel

Background: An adverse effect of air-pollution on cell physiology supposedly involves impairment of cell oxygenation and eventually - of its proliferation process. Aims: We assessed feasibility of using cell proliferation (CP) ratio of lymphocytes in umbilical cord blood as an indicator of a subclinical pathology in fetus which might be sensitive to environmental factors. Methods: We enrolled 210 Arab-Bedouin women giving birth in a local hospital. A questionnaire and cord blood samples were collected. This population is featured by high rates of birth anomalies and multiple environmental exposures, originating from the local industrial park (IP), frequent male smoking and open fire usage. Samples were maintained at +2C and tested by MTT Cell Proliferation Assay within 48 hours. Results: An average CP ratio was 2.4±1.2, Me=2.2, (0.3-6.7). Women in the 1st quartile (Q) of CP ratio were frequently diagnosed with preeclampsia compared with women in the 4th Q (6.0% vs. 0%, pv=0.05), they complained more about noisy neighborhood (14.7% vs. 2.5%, pv=0.04) and reported noise and vibration at their husbands' work (88.2% vs. 62.5%, pv=0.01; 61.8% vs. 37.5%, pv=0.04, respectively). Women in the 4th Q frequently lived in shacks or tents, used open fire or stove without chimney for heating or cooking (42.5% vs. 29.4% in 1st Q, NS) complained more about nearby transport (45.0% vs. 20.6%, pv=0.03) and smell (20.0% vs. 8.8%, pv=0.13). They were more likely to reside in the direction of a prevailing wind from the local IP (30.0% vs. 11.8%, pv=0.05). CP ratio was higher among newborns with minor anomalies (Me=2.9, n=8) compared to healthy newborns (Me =2.2, n=192). However, CP ratio among newborns with major anomalies was lower than in healthy newborns (Me =1.7, n=10). This disparity might reflect a different pathophysiology for minor and major anomalies. Conclusions: Proliferation of cord blood cells might be considered as an early subclinical indicator, sensitive to environmental exposures and reflective of birth anomalies.

Abstract Number	**P-1-13-04**
Presenter	Lertchai Charerntanyarak*, Friedrich Tiefenbrunner
Exposure	biomarker
Health domains	other
Type of research	occupational study

Cytogenetic biomonitoring of workers exposed to diethylamine, Analysis in peripheral blood lymphocytes.

Diethylamine is used as a corrosion inhibitor and in the production of pesticides, dyes, rubber, resins and pharmaceuticals. It is a colorless liquid with a fishy, ammonia-like odor. The legal airborne permissible exposure limit (PEL) is 25 ppm averaged over an 8-hour work shift (OSHA). Chromosome aberrations (CA), sister chromatid exchanges (SCE) and mitotic indices (MI) were the methods of cytogenetic effect. They were studied in the peripheral lymphocytes of 30 male workers occupational exposed to diethylamine and examined in the normal cultured human lymphocytes treated with different concentrations (10, 20, 100, 200 ppm) of diethylamine for 8, 24, 48, 72 hours. It was observed that an increment of the concentration of diethylamine led to a reduction of the amount of cells and their mitotic activity. At the concentration of diethylamine above 500 ppm showed a marked 50% reduction of growth and above 1000 ppm of diethylamine, a complete lack of metaphase cells was observed. CA, SCE and MI were found in a few cells of workers' blood when compared with controls (untreated cells). Stratifying for age of the worker, duration of their work and individual data did not change the substance of the results. Only one worker had 9% incidence of CA; 7% single chromatid gaps and 2% single chromatid breaks. The number of micronuclei was 0.94% thus ranging under the average of 1.06% calculated from all 30 blood samples.

Abstract Number	**P-1-13-05**
Presenter	Huixin Wu*, Yan Chang, Wanting Lin, Amanda Crow, Jacob McDonald, Amie Lund, Hooman Allayee, Frank Gilliland, Robert McConnell, Junfeng Zhang
Exposure	biomarker
Health domains	other
Type of research	exposure measurement

Determination of Polycyclic Aromatic Hydrocarbons in Adipose Tissues of Mice Following Long-term Exposure

Background: Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental contaminants that can exert genotoxic and carcinogenic effects in humans and animals, especially after chronic exposure. Due to their high lipophilicity, PAHs in the adipose tissue have been suggested to reflect long-term cumulative exposures. However, the lack of association between adipose PAH concentrations and age of female participants in a previous study has challenged above assumption. Objectives: To develop an HPLC-fluorescence method to determined PAH concentrations in adipose tissues; and to examine whether mice following long-term exposure to diesel exhaust would have higher adipose PAH concentration than unexposed mice. Methods: Adipose tissue samples were collected after the mice were exposed to either filtered air (control group) or a mixture of gasoline and diesel exhaust (exposure group) for 6 hr/day for 50 days. Following homogenization, the samples were extracted using a Soxhlet apparatus. The lipid was removed by solid-phase extraction and the final extract was analyzed using an HPLC-fluorescence method. Results: The method was sensitive enough to detect the thirteen PAHs in all or majority of the adipose samples weighing from 122 mg to 555 mg. The limits of detection ranged from 0.1 to 0.5 ng g-1 adipose tissue for these PAHs. The coefficient of variation (CV) for repeated measurements was less than 13.9% using spiked adipose tissue samples. The average recovery was approximately 57%. Among thirteen PAHs tested, the total amount of lighter PAHs (equal or less than four rings) accounted for 98.9%. No significant difference between exposure and control groups was observed (P>0.05) for predominant PAHs, except fluorine at a significantly higher level in exposure group (15.5±16.7) than in the control group (8.6±2.8) (P<0.01). Conclusions: The results suggest that PAHs may not accumulate in the adipose tissue after long-term exposure. Keywords: PAHs, adipose tissue, bioaccumulation, long-term exposure

Abstract Number	**P-1-13-06**
Presenter	Andre Schutze*, Marike Kolossa-Gehring, Petra Apel, Jürgen Angerer, Thomas Brüning, Holger M. Koch
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	exposure measurement

DINCH metabolites in urine samples of the German Environmental Specimen Bank (ESBHum) from 1999 to 2012: a retrospective exposure assessment

We analyzed 300 urine samples (24h voids) from the German Environmental Specimen Bank, for specific diisononylcyclohexane-1,2-dicarboxylate (DINCH) metabolites ranging from the simple monoester to several oxidized monoesters. Urine samples were collected in the years 1999, 2003, 2006, 2009 and 2012, 60 samples per year, from 30 male and 30 female volunteers (age: 21-29 years). The design of this retrospective study was chosen to investigate the time trend of DINCH exposure due to the market introduction of DINCH in 2002 and increasing production volumes ever since (to approx. 200,000 metric tons in 2012). The samples were analyzed by on-line HPLC-MS/MS with isotope dilution quantification. The LOQs for the oxidized DINCH metabolites are 0.05 µg/l and 0.1 µg/l for the monoester. All samples were blinded before analysis. We detected no DINCH metabolites in the 1999 and 2003 samples. From 2006 on the percentage of samples with DINCH metabolites above the LOQ increased significantly over the years (7% in 2006, 43% in 2009 and 98% in 2012). As expected, the hydroxyl monoester (OH-MINCH) was predominant followed by the carboxyl monoester (cx-MINCH) and the oxo monoester (oxo-MINCH). The median (and 95th percentile) of the OH-MINCH concentrations (in µg/L) increased from <LOQ (0.08) in 2006, to <LOQ (1.02) and 0.39 (2.09) in 2012. Similar trends, albeit at lower concentrations were observed for the other metabolites. All oxidized DINCH metabolites correlated strongly among each other over all concentrations spanning 4 orders of magnitude (rho>0.75, p>0.001). The median (95th percentile) DINCH intake in 2012 was calculated to be 0.14 (1.07) µg/kg body weight/day. Our results impressively show the advent and development of the exposure of the German population to DINCH since its market introduction in 2002. Daily intakes are still lower compared to the phthalates it is used for as a substitute; future measurements will enable us to monitor the development of exposure.

Abstract Number	**P-1-13-07**
Presenter	Kathleen M. Navarro*, Jennifer K. Mann, John R. Balmes, Thomas E. McKone
Exposure	biomarker
Health domains	no health domain
Type of research	exposure modeling

Enhancing the power of biomarkers: a polycyclic aromatic hydrocarbon case study in using biomarkers, emissions data and air quality modeling

Biomonitoring data provide a direct way to link the human exposure to environmental contaminants. However, these data do not reveal how various exposure routes or media contribute to the body burden of a specific chemical. Polycyclic aromatic hydrocarbons (PAH) are hazardous air pollutants formed during incomplete combustion and are detected in food, air, and soil. These chemicals readily enter the human body through inhalation and ingestion and are detected in urine as hydroxylated metabolites. Recent work by one of us and colleagues at the University of California, Davis revealed that modeled national data for PAH from outdoor and indoor emissions and food intake had the range of cumulative distribution as urinary PAH metabolite concentrations among 2003-2004 National Health and Nutrition Examination Survey (NHANES) participants. Building on that work, this project compares an individual's urinary PAH concentration from the 2001–2006 NHANES survey with several routes of exposure including food intake, indoor sources, and outdoor emissions. Food intake and indoor sources are estimated through each individual's questionnaire responses. Outdoor emissions of PAH are estimated from daily PM2.5 exposure estimates and air toxic emission data from US EPA National Air Toxic Assessment (NATA). The Hierarchical-Bayesian estimates of PM2.5 developed by USEPA were augmented to estimate daily outdoor concentrations of PAH at the census tract level. Multivariate linear regression models (MLRM) will be used to track the direct relationship between an individual's urinary PAH biomarkers and the various exposure pathways. This effort demonstrates the power of combining air emissions data and NHANES results together will spatially detailed models to elucidate exposure routes that could not otherwise be quantified.

Abstract Number	**P-1-13-08**
Presenter	Kristin Larsson*, Brita Palm, Margaretha Grandér, Karin Ljung, Maria Wennberg, Lennart Kaj, Bo A.G. Jönsson, Marika Berglund
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Environmental contaminants in hair and urine from Swedish mothers and children – an EU harmonized approach

Background: Sweden is one out of 17 countries participating in the European human biomonitoring project DEMOCOPHES aiming to harmonize biomonitoring and generate comparable data across Europe. Aim: The study aims to measure the levels of environmental contaminants in Swedish children and their mothers and to associate these levels with specific exposure sources, as well as to contribute to the overall objectives of the DEMOCOPHES project. Methods: Hair and urine samples were collected from 100 children (6-11 years) and accompanying mothers and a questionnaire about lifestyle, diet, living environment and socio-demographics was answered. The hair samples were analysed for mercury and the urine samples were analysed for cadmium, cotinine, bisphenol A, 10 phthalate metabolites, triclosan and 5 parabens. Results: The mean mercury concentration in hair was 0.26 (range 0.02-1.19) µg/g hair in the mothers and 0.18 (0.03-0.60) µg/g hair in the children. The mothers who frequently ate fish had higher levels of mercury than mothers who rarely or never ate fish. However, no such correlation was found among the children. The mean urinary cadmium level was 0.15 (0.02-0.87) µg/L in the mothers and 0.08 (0.03-0.29) µg/L in the children. The mean urinary bisphenol A concentration was 1.3 (0.2-6.3) µg/L among the mothers, which was slightly lower than the mean level among children (1.5 µg/L; range 0.3-32.4 µg/L). The children had higher levels than the mothers of all analyzed phthalate metabolites, except for MEP. There was an association between elevated levels of some of the phthalates and high consumption of chocolate or ice cream and PVC in flooring and wall material. The levels of parabens were higher in the mothers than in the children, which probably reflect the frequent use of personal care products among adult women. Conclusion: The concentrations of environmental contaminants were generally low. Children had higher concentrations of phthalate metabolites in urine, while mothers had much higher exposure to parabens.

Abstract Number	**P-1-13-09**
Presenter	Maribel Casas*, Damaskini Valvi, Raquel Garcia, Ana Ballesteros-Gómez, Carmen Iñiguez, Noelia Luque, Soledad Rubio, Mariana F. Fernandez, Jordi Sunyer, Martine Vrijheid
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

Exposure to BPA during pregnancy and fetal growth in a Spanish birth cohort

Background: Exposure to bisphenol A (BPA) during pregnancy may affect fetal growth and this effect may be sex-specific. Findings are inconsistent and based on only a handful of studies. Only two studies were able to examine BPA effects in specific fetal growth windows during pregnancy. Aims: To examine the association between prenatal BPA exposure and fetal growth during pregnancy windows based on ultrasound measurements in a prospective Spanish birth cohort study. Methods: BPA concentrations were measured in two spot urine samples collected in the 1st and 3rd trimesters of pregnancy (n=463). The average of the two creatinine-adjusted BPA concentrations was used as exposure variable. Ultrasound examinations at each pregnancy trimester were used to fit mixed-effects models and estimate longitudinal growth curves for femur length (FL), head circumference (HC), abdominal circumference (AC), biparietal diameter (BPD), and estimated fetal weight (EFW). These models were applied to calculate conditional standard deviation (SD) scores over pregnancy weeks 12-20 and 20-32. Multivariate linear regression models were adjusted for maternal characteristics (age, parity, education, social class, smoking status) and time of day of urine collection. Results:BPA concentrations (GM±GSD) were 2.5 ± 2.3 µg/g in 1stand 2.0 ± 2.3 µg/g in 3rd trimestersamples (correlation=0.15, p=0.001).Exposure to BPA during pregnancy was negatively associated with FL and EFW during weeks 12-20 in boys (FL: β SD-score for 10-fold increase in µg/g BPA =-0.51, 95%CI=-0.92,-0.10; EFW: β=-0.59, 95%CI=-1.04, -0.14). None of the other fetal parameters was associated with urinary BPA concentrations, and there were no associations in the 20-32 week period or in girls. Conclusions: Maternal BPA exposure during pregnancy may reduce certain growth parameters in the male fetus. Uncertainties in BPA exposure assessment require that findings be interpreted with caution.

Abstract Number	**P-1-13-10**
Presenter	Susan Teitelbaum*, Luca Lambertini, Qian Li, Fiorella Belpoggi, Laura Falcioni, Luciano Bua, Manori Silva, Xiaoyun Ye, Antonia M. Calafat, Jia Chen
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Identification of endocrine disrupting chemical doses in rats to reproduce human urinary metabolite concentrations

We are investigating the effects of the exposure of female Sprague-Dawley rats to 3 endocrine disrupting (ED) chemicals, diethyl phthalate (DEP), methyl paraben (MPB), triclosan (TCS), and their mixture, on 6 mammary cancer susceptibility windows. The ideal animal experiment would utilize multiple chemical doses, but budgetary constraints required the choice of a single dose for each ED. Most animal studies have tested ED effects with doses that are orders of magnitude higher than common human exposure. We have conducted a dose calibration study to determine the oral dose of each ED that would result in rat urinary metabolite concentrations comparable to the concentrations reported in the general US population. We used five doses per chemical based on its NOEL (No Observed Effect Level in mg/Kg/day; MBP=1050; TCS=50; DEP=1735) plus one control group (vehicle only); 5 adult female rats per chemical/group were dosed by oral gavage for 5 days. Doses ranged from 0.0005-173 mg/kg/day. Urine and blood, collected on the last day of exposure, were analyzed for ED metabolites by solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry. We used linear regression to assess relationships between oral dose and metabolite concentration. For all chemicals, the urine concentrations at the three lowest doses plus control demonstrated a very strong linear relationship (R2>0.82). NOEL/10,000 (MPB, DEP) or NOEL/1,000 (TCS) doses resulted in urinary concentrations that were within the US population concentration range. The serum concentrations did not show a clear dose response for MEP and MPB. The relationship between serum and urine concentration varied by metabolite (R2: MEP:0.085; MPB:0.58; TCS:0.93). This dose calibration study facilitated the selection of oral doses that closely mimic the exposures experience of the human population, thereby providing an opportunity to examine the effect of realistic ED exposures on genetic dysregulation in rodent mammary tissue. Supported by NIEHS/NCI: 5U01ES019459

Abstract Number	**P-1-13-11**
Presenter	Ching-Chang Lee*, Chung-Yu Chen, Yen-Yin Chou, Shio-Jean Lin
Exposure	biomarker
Health domains	no health domain
Type of research	cross-sectional study

Intervention strategy development on phthalates exposure reduction for girls

Background:Children in Taiwan seem exposed higher concentration of phthalates, especially for di-n-butyl phthalate (DBP) and bis(2-ethylhexyl) phthalate (DEHP). Aims: This research is aimed to explore intervention strategy which could effective to reduce the phthalate exposure in girls. Methods: 30 girls were recruited from the policlinic of Pediatric Endocrinology in National Cheng Kung University Hospital and local elementary school in 2010. Participants were asked to limit the usage of plastic container, microwave food, nutrition supplements, medication, cosmetics, personal care products, and food with plastic bag or wrap covered. Pre-intervention and post-intervention urine samples were collected during one week intervention. A questionnaire was developed to monitor the intervention compliance.Eight urinary phthalate metabolites including MMP, MEP, MBP, MBzP, MEHP, MEOHP, MEHHP,and MECPP were analyzed by HPLC-MS/MS. Results: The dominant phthalate metabolites in urine samples were MBP, followed by MEHHP and MECPP. The geometric means of eight phthalate metabolites levels in post-intervention urine samples were significantly lower than pre-intervention ($p<0.01$). The hand-washed frequency is positively associated with the decreasion of urinay MBP levels (geometric mean: 130.1 ng/mL) ($p=0.01$). We also found limited consumption of beverages with plastic cup could significantly decreased the urinary levels of MBP ($p=0.018$), MEOHP ($p=0.079$), MEHHP ($p=0.042$), and MECPP ($p=0.013$). To reduce the usage of shampoo and shower gel also contribute to decrease the levels of urinary MBP ($p=0.066$) and MEP ($p=0.072$). Conclusions: In this study, we found that the levels of urinary MBP decreased with increasing hand-washed frequency and limiting consumption of beverages with plastic cup in girls. Meanwhile, the concentration of urinary DEHP metabolites decreased with limiting consumption of beverages with plastic cup.

Abstract Number	**P-1-13-12**
Presenter	Virissa Lenters*, Lützen Portengen, Anna Rignell-Hydbom, Bo A.G. Jönsson, Christian H. Lindh, Aldert H Piersma, Gunnar Toft, Jens Peter Bonde, Dick Heederik, Lars Rylander, Roel Vermeulen
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

Penalized multivariate analysis of prenatal exposure to phthalates, perfluorinated compounds and organochlorines and birth weight

Background: Evidence for effects of environmental contaminants on birth outcomes is equivocal, in part due to difficulties in disentangling the effects of mixtures. Aims: We investigated associations between multiple exposures and birth outcomes, using multivariate dimension reduction and variable selection approaches to account for multiple testing and collinearity of exposures. Methods: We evaluated a cohort of 1322 singletons, born to 547 mothers from Greenland, 197 from Warsaw, Poland, and 588 from Kharkiv, Ukraine, who were recruited in 2002-2004 during routine antenatal care visits. Secondary oxidized metabolites of diethylhexyl and diisononyl phthalates (DEHP, DINP), eight perfluorinated compounds (PFCs), and organochlorines (p,p'-DDE and PCB-153) were detected in 72-100% of maternal serum samples. Outcomes were preterm birth (<37 weeks; n=58), gestational age, and birth weight of all and full-term infants. We assessed associations between exposures and continuous and dichotomous outcomes with respectively partial least squares (PLS) regression and sparse PLS-discriminant analysis. We also performed elastic net penalized regression, including maternal age, BMI, height and serum cotinine, and gestational age as covariates. Results: While applied methods had various degrees of sparseness, we observed generally consistent associations between several phthalates and PFCs and both organochlorines, and decreased birth weight. There were indications that some PFCs and organochlorines were associated with decreased gestational age, but no clear evidence of associations with preterm birth. Conclusions: Findings suggest that several contaminants are independently associated with adverse birth outcomes; whether associations are causal remains to be established. Applied methods may better cope with multiple correlated exposures—typical of exposome data—and thus better discriminate robust exposure-response associations than univariate linear and logistic regression models.

Abstract Number	**P-1-13-13**
Presenter	Ryan Lewis*, John D. Meeker, Karen E. Peterson, Lourdes Schnaas, Alejandra Cantoral Preciado, Martha Maria Tellez-Rojo Solis
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Predictors of Urinary Bisphenol A and Phthalate Metabolite Concentrations in Mexican Children

Background: The potential for early life exposures to BPA and phthalates to alter child growth and maturation has received much attention given the ubiquity of exposures and ability of these chemicals to disrupt endocrine function. Studies concerning predictors of exposure to BPA and phthalates in children are limited. Aims: To identify predictors of urinary concentrations of BPA and phthalate metabolites in peripubertal girls and boys. Methods: We measured concentrations of BPA and 9 phthalate metabolites in urine samples from 108 Mexican children aged 8-13 years. Associations of age, time of day, and questionnaire items on external environment, water use, food container use, and personal care product use with specific gravity-corrected urinary concentrations were assessed with Wilcoxon rank-sum tests and multivariable linear regression models. Results: There were no statistically significant ($p<0.05$) associations between urinary concentrations of the analytes and age, time of day, external environment, water use, or food container use. After adjusting for other personal care product use in the past 48-hr, there were statistically significant associations in boys for cologne/perfume use (MEP, MCPP, MEHHP, MEOHP) in the past 48-hr and in girls for colored cosmetics (MBP, MEHP, MEHHP, MEOHP, MECPP), conditioner (MEP), deodorant (MEP), and other hair products (MBP) use in the past 48-hr. There was also a statistically significant positive trend for the number of personal care products used in the past 48-hr and urinary concentrations of log-MEP in girls. Conclusions: Concurrent personal care product use is associated with exposure to multiple phthalates in children. Since children are potentially sensitive to the developmental effects of phthalate exposure, reduced or delayed use of certain personal care products among children may be warranted.

Abstract Number	**P-1-13-14**
Presenter	Thomas Schettgen*, Jens Bertram, Thomas Kraus
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

Quantification of the mercapturic acids of acrylonitrile and its genotoxic metabolite cyanoethylene-epoxide in a pilot human biomonitoring study

Background: Acrylonitrile is one of the most important monomers in plastic production worldwide with an enormous production volume. Acrylonitrile is a known animal carcinogen and also a major constituent of tobacco smoke, which is the main source of exposure for the general population. Aims: The metabolic conversion of acrylonitrile to its genotoxic metabolite cyanoethylene-epoxide in humans by liver cytochromes is mainly responsible for the carcinogenic properties of acrylonitrile. Therefore, our research was aimed to elucidate this metabolic pathway in humans. Methods: Based on previous works, we have developed a highly sensitive and specific LC/MS/MS-method to simultaneously quantify the specific mercapturic acids of acrylonitrile (N-acetyl-S-(2-cyanoethyl)cysteine, CEMA) and its oxidative metabolite cyanoethylene-epoxide (N-acetyl-S-(1-cyano-2-hydroxyethyl)cysteine, CHEMA) in human urine. The limit of quantification for both metabolites was 1 µg/L urine. In a pilot study we applied this method to spot urine samples of 47 non-smoking and 36 smoking persons of the general population with no occupational exposure to acrylonitrile. Results: Median levels for CEMA and CHEMA in urine samples of non-smokers were 1.9 and < 1 µg/L urine. CHEMA was quantified only in 4 of the 47 samples. In contrast, both metabolites were quantifiable in more than 94 % of the smokers' urine samples. Excretion of CEMA was highly correlated to anamnestic information about daily smoked cigarettes. Median levels of CEMA and CHEMA were 184 and 29 µg/L urine, respectively. The mean relationship between CHEMA and CEMA in these samples was 13 %, but showed high variability, which was potentially caused by individual susceptibility. Conclusions: Our method is highly suitable for human biomonitoring of exposures to acrylonitrile and the future derivation of risk-based biological guidance values.

Abstract Number	**P-1-13-15**
Presenter	John Wambaugh, Anran Wang, Cory Strope, Daniel Chang, Rocky Goldsmith, Peter Egeghy, Kristin Isaacs, Alan Liddell, Richard Judson, R. Woodrow Setzer, Elaine Cohen Hubal, Daniel Vallero*
Exposure	biomarker
Health domains	no health domain
Type of research	exposure modeling

Rapidly Parameterized Consumer Use Modeling for High-Throughput Exposure Predictions

Background: High-throughput, typically in vitro, biological activity assays allow the ToxCast™ and Tox21 projects to compare the biological activity of chemicals with known in vivo toxicity to those with little or no in vivo data. Further in vitro assays characterize key aspects of pharmacokinetics and allow in vitro-in vivo extrapolation to predict human uptake (mg/kg/day) that might be sufficient to cause bioactivity in vivo. Aims: Without a similar capability to make quantitative, albeit uncertain, forecasts of exposure, the putative risk due to an arbitrary chemical cannot be rapidly evaluated. Methods: Using physico-chemical properties and provisional chemical use categories, most of the ~10,000 Tox21 chemicals have been evaluated with respect to exposure potential from near-field sources. A mapping of chemicals to products, and products to uses, has been used to categorize chemicals with respect to potential uses within the home. A Bayesian methodology is used to infer ranges of exposures consistent with biomarkers measured in urine samples and reported by the National Health and Nutrition Examination Survey (NHANES) in 2012. For each demographic group reported by NHANES we consider permutations of linear regression models, including as few as one and as many as all physico-chemical and use factors. Results: The linear regression provides a predictor, calibrated to the NHANES data, that can be applied to the remainder of the Tox21 list. The variance of this calibration serves as an empirical determination of uncertainty. These exposure predictions are then directly compared to the doses predicted to cause bioactivity for ~250 ToxCast chemicals. Conclusions: For chemicals with no other source of information, this approach allows prediction of confidence interval within which the average human exposure due to near field sources is likely. This abstract does not necessarily reflect U.S. EPA policy.

Abstract Number	**P-1-13-16**
Presenter	Hendrik Modick*, Georg Dierkes, Andre Schutze, Claudia Pälmke, Tobias Weiß, Thomas Brüning, Holger M. Koch
Exposure	others
Health domains	other
Type of research	exposure measurement

Simultaneous determination of the major aniline metabolites in human urine by on-line turbulent flow chromatography HPLC-MS/MS

Aniline is used in many industrial processes (e.g. rubber, colorants, pesticides and pharmaceuticals) and determining exposure to aniline is both of occupational and environmental relevance. In biological monitoring exposure to aniline has traditionally been assessed by measuring total aniline after hydrolysis in urine and/or covalent haemoglobin adducts in blood. However, we know from animal studies that the major urinary metabolite of aniline is N-acetyl-para-aminophenol (para-NAAP), representing 56%-76% of the dose. NAAP is also known as acetaminophen/paracetamol. Another urinary Aniline metabolite is N-phenylacetamide (NPA), representing approx. 3 % of the dose. Formation of other ring-hydroxylated and N-acetylated metabolites, e.g. N-acetyl-ortho-aminophenol (ortho-NAAP) has been reported. Human biomonitoring data on the body burden of the general population (and potentially exposed subpopulations) to para-NAAP, ortho-NAAP and NPA is scarce to nonexistent. Also, until now, no data on human metabolism of aniline is available. To be able to investigate human aniline metabolism and consecutively to determine the internal body burden of para-NAAP, ortho-NAAP and NPA in the general population, in workers exposed to aniline and users of Acetaminophen/Paracetamol, we developed a fast on-line turbulent flow HPLC-MS/MS-method with isotope dilution quantification in urine.For on-line extraction and enrichment of the analytes we used a Waters Oasis HLB precolumn. Chromatographic separation was performed on a Thermo Scientific Hypercarb column. Limits of quantification were 0.2–10 µg/L depending on the analyte. In a first application in urines of occupationally not aniline exposed volunteers we could quantify para-NAAP and ortho-NAAP in all samples analyzed, but NPA could not be quantified in any of the samples. However, in urine samples of persons exposed to aniline at levels typical for occupational settings we could quantify NPA, albeit at rather low levels.

Abstract Number	**P-1-13-17**
Presenter	Nadia Vilahur*, Nadia Vilahur, Andrea A Baccarelli, Mariona Bustamante, Silvia Agramunt, Hyang-Min Byun, Mariana F. Fernandez, Jordi Sunyer, Xavier Estivill
Exposure	biomarker
Health domains	no health domain
Type of research	others

Storage conditions and stability of global DNA methylation in placental tissue for Epidemiology Studies.

Background: There is growing interest on the epigenetic effects of in-utero environmental exposures on DNA methylation and its relation to childhood or adult-life health outcomes. The placenta is a well-established target of environmental toxicants that can be easily collected in epidemiological studies. However, no study has yet analyzed to what extent storage conditions of placental tissue after delivery affect DNA methylation. We designed a study to address this issue providing informative results for on-going and future cohort studies. Methods: Two full term placentas were biopsied in three different regions of the villous parenchyma. Biopsies were sequentially stored at -80°C after standing at room temperature (RT) for 30 minutes, 1 hour, 2 hours, 6 hours and 24 hours. Global DNA methylation was measured by two common techniques: analysis of retrotransposons by pyrosequencing (10 different repetitive elements in LINE, Alu and HERV families) and the Luminometric Methylation Assay (LUMA). Time-to storage at RT, technique-related and regional variability in methylation levels were compared by coefficients of variation (COV). Results: The time-to storage COV was 2.49% (placenta 1) and 2.86% (placenta 2) 5-methylcytosine (5mC), similar to the mean technical variation we observed for the pyrosequencing technique (COV=1.91% and 1.51% for each placenta, respectively). LUMA yielded more variable results, both among time points and as well as between technical replicates. Conclusion: DNA methylation levels are not affected by storage delays at RT. DNA methylation studies using samples stored in unknown or suboptimal conditions should avoid using techniques sensitive to DNA degradation such as the LUMA Assay.

Abstract Number	**P-1-13-18**
Presenter	Sherry (Xiaoyun) Ye*, Lee-Yang Wong, Xiaoliu Zhou, Antonia M. Calafat
Exposure	biomarker
Health domains	cancer
Type of research	exposure measurement

Trends in urinary concentrations of 2,4-dichlorophenol and 2,5-dichlorophenol in the U.S. Population: National Health and Nutrition Examination Survey 2003–2010

Background: 2,4-dichlorophenol (2,4-DCP), 2,5-dichlorophenol (2,5-DCP) and their precursors are widely used in industry and in consumer products. Urinary concentrations of 2,4-DCP and 2,5-DCP have been measured as part of the National Health and Nutrition Examination Survey (NHANES) to assess the exposure to these compounds or their precursors among the U.S. general population. Aims: To evaluate the determinants of concentrations and the trends in concentrations of 2,4-DCP and 2,5-DCP based on race/ethnicity, age, sex, and household income. Methods: We determined the urinary concentrations of 2,4-DCP and 2,5-DCP in NHANES 2003–2010 participants by on-line solid-phase extraction–isotope dilution-high performance liquid chromatography-tandem mass spectrometry. Results: We detected 2,4-DCP and 2,5-DCP in over 81 % (2,4-DCP) and 97 % (2,5-DCP) of participants. Least square geometric mean (LSGM) urinary concentrations of 2,4-DCP and 2,5-DCP among children and adults older than 60 years were higher than among adolescents and other adults. LSGM concentrations of 2,4-DCP and 2,5-DCP among non-Hispanic whites were significantly lower than among non-Hispanic blacks and Mexican Americans, except among high income households. We observed a downward trend in LSGM concentrations for non-Hispanic blacks and Mexican Americans as family income increased. Type of housing was a significant determinant of 2,4-DCP and 2,5-DCP urinary concentrations above the 95th percentile. Furthermore, urinary concentrations of 2,4-DCP and particularly those of 2,5-DCP showed a downward trend since 2003. Conclusions: Exposure to 2,4-DCP, 2,5-DCP, and their precursors was prevalent in the general U.S. population in 2003–2010. We identified age and race/ethnicity, family income and housing type as predictors of exposure to these compounds.

Abstract Number	**P-1-13-20**
Presenter	Luke P Naeher, Dana Boyd-Barr, Olorunfemi Adetona, Christopher Simpson*
Exposure	biomarker
Health domains	no health domain
Type of research	occupational study

Urinary levoglucosan as a biomarker for woodsmoke exposure in wildland firefighters

Background: Levoglucosan, a sugar anhydride and a combustion breakdown product of cellulose is a dominant organic constituent of particles in woodsmoke. After exposure, levoglucosan is excreted unmetabolized in urine. Aim: Urinary levoglucosan was assessed as a biomarker of occupational woodsmoke exposure among wildland firefighters. Methods: Urine samples were collected from wildland firefighters before and after their work-shifts on days when they worked at prescribed burns. A total of 97 pairs of pre- and post-shift urine samples were collected from 19 firefighters over 10 prescribed burn shifts. The urine samples were analyzed to determine whether there was an increase in the concentration of levoglucosan from pre- to post-shift after the firefighters had worked at prescribed burns. Results: Overall, there was an increase in both the urinary volume-based and creatinine-corrected levoglucosan concentrations from pre- to post-shift ($p < 0.05$). However, the direction of change in the concentrations was not consistent. There were increases in urinary levoglucosan concentration from pre- to post-shift in 63% of the person-day samples, and in only 58% of the person-day samples for the creatinine corrected concentrations. Conclusion: Although, there was an overall increase in urinary concentrations, of levoglucosan, results suggest that other sources apart from woodsmoke impacted the urinary levels of this biomarker in the wildland firefighters. Therefore, urinary levoglucosan may not be effective as a biomarker of woodsmoke exposure in this setting.

Abstract Number	**P-1-14-01**
Presenter	Andreas Tornevi*, Lars Barregård, Bertil Forsberg
Exposure	water
Health domains	infectious diseases
Type of research	time series study

A comparison between two different incidence indicators of gastrointestinal illnesses in a Swedish drinking water study

Background: We have earlier studied how precipitation effect quality parameters in a fresh water supply for citizens in Gothenburg, Sweden. We concluded that the quantity of preceding rainfall are a superior predictor to concentrations of indicator bacteria's at the river water intake to their drinking water utility. Moreover, we have studied associations between rainfall and nurse advice calls from households that are distributed drinking water produced from this water utility. We identified that heavy rainfall was associated with an increase in daily number of phone calls concerning gastrointestinal illnesses (GI calls) 4-6 days later. We also observed that consecutive days of wet weather increased daily number of GI calls. Aim: Evaluate relations between GI visits to primary health care centers and nurse advice calls in entire, and subparts of, Gothenburg. This is of interests since we are studying causality of disease that normally doesn't need prescribed medicine or a doctor's advice, and this study will enlighten the similarities and differences of these types of health data. Method: We adjusted for seasonality and time trend, day of week and holidays in both GI health indicators separately with use of GAM models. We calculated cross correlations of lags -15:15 of the two model residual series to compare short-term associations. Results: No clear short-term associations were found between visits to primary care centers and nurse advice calls concerning gastrointestinal health (n days=758). Different seasonality patterns were observed with increasing GI visits in late summer compared to GI calls. GI calls have more distinct winter peaks than GI visits. Conclusions: The two different GI incidence data seems to be independent in short-term variations and we suspect that they represent different types of GI illnesses. Persons with virus-like GI symptoms are usually not recommended to visit a health care centers, why nurse advice calls may be a better outcome to study than visits.

Abstract Number	**P-1-14-02**
Presenter	Deena Thomas*, Howard Hu, Niladri Basu, Brisa N. Sánchez, David C. Bellinger, Lourdes Schnaas, Adriana Mercado-García, Karen E. Peterson, Sung Kyun Park, Mauricio Hernández-Avila, Mara Tellez Rojo
Exposure	drinking water
Health domains	neurobehavioral effects
Type of research	cohort study

A prospective study of prenatal exposure to fluoride and neurobehavior: preliminary analyses

Background: Recent studies have reported an inverse association between fluoride exposure and IQ in children, but few had individual measures of exposure, measures of exposure during early life or a prospective design. Aims: This project is utilizing the Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) cohort and associated archived samples and data to study patterns of fluoride exposure during pregnancy and their association with subsequent neurobehavioral outcomes. Methods: Fluoride levels from archived maternal trimester 1, 2 and 3 urines were measured among 250 of 1200 available mothers-infant pairs and correlated across trimesters. Mental Development Index (MDI) scores at ages 1, 2 and 3 were derived using the Bayley Scales of Infant Development-II test. Generalized linear models were used to model the association between trimester-specific fluoride exposures and MDI at ages 1-3, adjusting for maternal age, education, marital status and smoking status. Results: The mean(SD) values for the 1st, 2nd and 3rd trimester urinary fluoride levels were 0.85(0.51), 0.85(0.67) and 0.82(0.56) mg/L. The Spearman correlations of urinary fluoride levels between the trimesters were all statistically significant: 1stv. 2nd(0.25), 1stv. 3rd(0.28), and 2ndv. 3rd(0.44). The trimester 1 urinary fluoride levels predicted lower offspring MDI scores at age 1 (β = -0.05, N=101), 2 (β= -0.43, N=121) and age 3 (β= -2.09, N=113), but none of the associations reached statistical significance. Conclusion: This preliminary analysis suggests that fluoride exposure varies widely by trimester, highlighting the need for repeated measures to capture prenatal exposure; and that first trimester fluoride exposure may be associated with adverse offspring neurobehavioral outcomes. A more robust analysis is pending.

Abstract Number	**P-1-14-03**
Presenter	Meryl Pearce-Churchill*, Eileen Willis, Susan Lawrie
Exposure	water
Health domains	healthrelated quality of life
Type of research	health impact assessment

Are we sending mixed messages to remote indigenous communities? Water for healthy living versus water conservation.

< Significant expenditure on water services to Indigenous communities in Australia has led to above average water use in areas where surface water is minimal and aquifers variable. In some parts supplies are not sustainable beyond a decade. Given these and climate change constraints there is a need for efficient use of water. Thus the authors were tasked with designing a conservation strategy suitable for such communities. One aim of the study was to document residents' water conservation behaviours. However, there is a significant gap between the health of Indigenous and non-Indigenous Australians; life expectancy is 17 years less for Indigenous people. Infant mortality is 12 deaths/1000 live births in the Indigenous population compared to 4 deaths in the non-Indigenous population. Water-washed diseases are disproportionately high, with Australia the only developed country still to have blinding trachoma. Given this health context a second aim of the study was to assess whether water consumption in two remote Indigenous communities in South Australia was adequate for healthy living. Water conservation data were obtained via focus groups in 2011; actual consumption data for a 5-year period were obtained from the service provider. The work of Nganampa Health Council (1987) and Pholeros et al. (1997) were used to benchmark the water requirements for healthy living. Adapting their figures to account for housing occupancy yielded a range of 101-456 litres/person/day. Water use in Mimili was above the minimum level required for healthy living but did not exceed the maximum amount. The higher water use occurred during summer. In Amata water use was high (470-616 litres) during summer but for the remainder of the year was <453 litres/person/day. Given the vulnerability of water resources there is a need for conservation programmes but it is important that they do not undermine the health improvements made in the last decade.

Abstract Number	**P-1-14-04**
Presenter	Gugliemina Fantuzzi*, Elena Righi, Guerrino Predieri, Gabriella Aggazzotti
Exposure	water
Health domains	skin disease
Type of research	cross-sectional study

Cutaneous symptoms in indoor swimming pools workers

Background and aim As a part of an Italian study on health effects of swimming pools employees, the aim of this study was to investigate the prevalence of self-reported cutaneous symptoms in indoor swimming pools workers, as some epidemiological studies suggested high prevalence rates of eczema in subjects working inside the pool water as trainers, pool attendants and hydro therapists. Materials and methods Information about the health status of 133 employees was collected by a structured questionnaire. The questionnaire recorded demographic characteristics, lifestyle, working related activities (kind of job, number of working hours by day and week, previous or parallel jobs) and symptoms related to cutaneous apparatus (verruca, mycosis, eczema and rash). Results Most of the swimming pool workers were females (52.6%), with a mean age of 33 ys, non-smokers (48.9%), working in swimming pools for an average of 8 years: no statistical differences were observed.. According to the questionnaire data, 50% of the subjects had attended indoor swimming pools for more than 20 years, mainly as swimmers. The prevalence of cutaneous diseases in the investigated subjects was: rash (20.3%), verruca (16.5%), mycosis (15.8%) and eczema (9.0%). However, subjects who declared to spend some hours inside the pool water during their working activities experienced generally more verruca (20.8% vs 3.1%), mycosis (17.8% vs 9.4%) and eczema (9.9% vs 6.2%) than other employees without any activities in the pool water. Rash frequency was very similar (20.3% and 21.9%) in both the categories of workers. Conclusion This study confirms that lifeguards and trainers are more at risk for cutaneous diseases than subjects with other occupations at swimming pool facilities. However, even though our study does not specifically include hydro-therapists, we did not find more eczema or rash in trainers who entered the pool water during their teaching activities when compared with other investigated employees.

Abstract Number	**P-1-14-05**
Presenter	José Luis Texcalac Sangrador*, Horacio Riojas Rodríguez, Alan Castillo Ferraez
Exposure	no exposure
Health domains	other
Type of research	others

Detection of spatio temporal clustering of cases of childhood leukemia in Lerma-Chapala watershed

Background Cluster detection is an important part of spatial epidemiology because it can help identifying environmental factors associated with disease and thus guide investigation of the aetiology of diseases. Leukemia is a rare disease: less than ten new cases are diagnosed per year per 100,000 population. Nevertheless, the disease has received a great deal of attention-more than soine more common diseases-because it is highly fatal, particularly in children, in whom it generally takes an acute form. Methods The present analysis examines spatial-temporal patterns of the cases and rates within these clustered areas. An analysis were conducted for Lerma-Chapala watershed in Mexico considering infant leukaemias for the period 2000-2010. We use a disease mapping model. The BYM model, named after Besag, York and Mollie, was originally developed for pattern recognition. The model has also been used in spatial epidemiology for disease mapping and in ecological studies. The model consists of two parts. In the first part the cases are assumed to follow a Poisson distribution with an area specific parameter ϕi. The second part is a log-linear model with a grand mean α, an offset log(ni), an uncorrelated component vi, and a correlated component ui. A cluster is defined as an area where the estimated relative risk is "significantly" (in terms of their credibility sets) larger than 1. Explanatory variables are easily included, but the facilities for spatio-temporal model extensions to detect local clusters in space and time are not comparable. Results and Conclusions We are currently completing the analysis that will allow us to show the clustering of cases and rates in the study area.

Abstract Number	**P-1-14-06**
Presenter	Ngueta Gerard*, Patrick Levallois, Michèle Prévost, Robert Tardif, Belkacem Abdous
Exposure	water
Health domains	other
Type of research	cross-sectional study

Estimating the impact of drinking water lead concentration on blood lead levels in children aged 1-5 years by using a cumulative index of exposure.

Background: Drinking water is recognized as source of children's lead (Pb) exposure. However, questions remain about the impact of chronic exposure to lead-contaminated water on internal dose. Objective:The goal was to estimate the relation between a cumulative water lead exposure index (CWLEI) and blood lead levels (BLLs) in children. Methods: We studied 299 children aged 1-to-5 years. During a home visit, children's and water consumption data were obtained by an in-home interview questionnaire. Tap water was collected from the kitchen as well as floor and windowsill dust. Pb from interior painted surfaces was evaluated. Venous blood was drawn and Pb analyses were performed by inductively coupled plasma mass spectroscopy. Taking into account seasonal changes of water Pb levels across the year, we constructed a CWLEI by cumulating the expected values of daily Pb uptake over the 150 days previous the day of blood collection. The CWLEI was first modeled as a continuous variable and subsequently categorized into quartiles. The multiple linear regression was used to estimate the effect of CWLEI on BLLs after adjusting for floor and windowsill dust loadings, paint Pb levels, child's age, gender, race, season of blood collection, mother's education level, and the number of meals per day. Results: CWLEI was positively related to BLLs and for each additional increase of 1 unit of CWLEI, BLLs increase of 1.08 µg/dL (p=0.0002). BLLs in children with CWLEI of 0.482-1.374 µg/kg of bw and ≥ 1.374 µg/kg of bw were 1.24 (95%CI: 1.05 – 1.47) and 1.33 (95%CI: 1.11 – 1.59) times respectively greater, compared with BLLs from bottom category (< 0.124 µg/kg of bw), and after adjusting for confounders. Conclusion: Water lead markedly influenced BLLs starting at a CWLEI of 0.482 µg/kg of bw. This corresponds to 0.003 µg/kg/day. For a child aged 1 year (bw≈12kg; daily water intake≈0.30L), the maximum acceptable value for lead in drinking water was estimated 0.12 µg/L.

Abstract Number	**P-1-14-07**
Presenter	Pei-Chih Wu*, Bo-Wei Huang, Wan-Ting Chen, Ching-Yi Horng, Hung-Yu Shu, Zhou-Chen Horng
Exposure	water
Health domains	infectious diseases
Type of research	exposure measurement

Evaluation of Microbial Contaminations from Emergency Eyewash and Shower Fluid in Southern Taiwan

Background. Emergency eyewash and shower stations were usually unused for months or years, which may represent a reservoir for many waterborne and indoor microorganisms. Aims. This study therefore aims to sample the flush water or fluid from selective emergency eyewash and shower stations in industries, senior high school and colleges and assess the microbial contamination and other water quality indicators. Methods. Heterotrophic bacteria, free chlorine, water temperature, pH, conductivity, turbidity, and suspended solids will be measured in all water/fluid samples. A checklist will used to evaluate the characteristics of stations such as type of stations, way and frequency of maintenance, age and other functional indicators comply with guidance of emergency eyewash and shower stations in Taiwan. Results. Our study established the checklist for the performance and maintenance of emergency eyewash and shower stations for field survey and conducted 48 stations from industrial and universities. One hundred and eighty-two water samples were collected for the analysis of various water quality indicators. The results showed that 94 % flushing water with insufficient free residual chlorine, 25 % flushing water with higher turbidity and 60 % flushing water with heterotrophic bacteria higher than drinking water standard. Among the characteristics of facilities and water indicators, the insufficient free residual chlorine in flushing water have been found to be the key factor in heterotrophic bacteria contamination with statistical signigicance in logistic regression model. Conclusions. Emergency eyewash and shower stations were usually unused for months and the water quality will deteriorate. People might expose to bad quality water in the emergent need and increase the potential risk of waterborne infection. Guidance of maintenance including flushing frequencies and decontamination system should be recommended in the near future in Taiwan.

Abstract Number	**P-1-14-08**
Presenter	Kuo-Chang Hung*, Chao-Yu Guo, Mu-Jean Chen, Huey-Jen Su
Exposure	water
Health domains	infectious diseases
Type of research	time series study

Extreme Precipitation may Enhance Occurence of Enterovirus and Shigellosis

Background:Disruptions of global climate are reported to increase the variation of extreme precipitation, suggested as an indirect factor for modifying pandemic areas of infectious disease such as entroviurs and shigellosis. Yet, only limited studies have established the quantitative relationships between precipitation and occurrence of entroviurs and shigellosis in a subtropical region like Taiwan. Aims: We assessed the relationship between the extreme precipitation and the entroviurs and shigellosis occurrence in Taiwan. Methods:The meteorological data was acquired from the 33 meteorological stations of Central Weather Bureau and 372 automatic precipitation observation stations of Central Weather Bureau in Taiwan from 1994–2008. The disease information was mandatory communicable disease report data that was extracted from Taiwan Centers for Disease Control of the same period. We use Generlized Additive Model (GAM) with nonparametric regression to assess the associations. Results:The averaged 95th and 99th percentile of precipitation for all 352 townships in Taiwan over the 15 year period were 32mm and 93mm, respectively. There were 4,972 and 1,638 shigellosis and enterovirus cases. Precipitation with 4-days lag and 6-day lag had both significant relationships with shigellosis and enterovirus occurrences. In particular, the 99th percentile of precipitation of prior 6 days may increase shigellosis occurrence by 6%, compared to the drought days. Conclusions:Our findings evidence that the extreme precipitation may noticeably increase the occurrences of shigellosis and enterovirus.

Abstract Number	**P-1-14-09**
Presenter	Emmanuella Onyenechere*, Eleazu Ebere
Exposure	drinking water
Health domains	healthrelated quality of life
Type of research	cohort study

HEALTH IMPLICATIONS OF THE QUALITY OF WATER FROM WATER VENDORS' SOURCES OF SUPPLY IN A NIGERIAN URBAN CENTRE: THE CASE OF ENUGU NORTH, NIGERIA

Background: Water supplied by vendors furnishes a valuable service for communities with limited or no access to piped water. Oftentimes the consumer will not be aware of the source of the water and there may be concerns about the quality of the water. Aim: The study analyzes the quality of water from the different vendors' supply sources and relates it to health of consumers. Methods: Data were obtained through questionnaires administered to 200 households and 60 water vendors. Samples of water from the different water sources abstracted by vendors were collected and analyzed. Confirmatory data on the incidence of water-related diseases were obtained from major health facilities to ascertain levels of incidence of those diseases. Results: Results of the pH, temperature, total dissolved solids, total hardness, turbidity, color, and coli form count of water samples revealed the pollution levels of the water sources when they were compared with the World Health Organization guidelines for drinking water quality. The study revealed that 42.2 percent of the respondents have suffered from water related skin infections/dermatitis, 34.5 percent from typhoid fever, while 23.3 percent have suffered from diarrhea. The incidence of diarrhea is highest in GRA ward; the incidence of skin infections/dermatitis is highest in Onuasata, while the incidence of typhoid fever is highest in Hilltop/Udi Siding ward of Enugu North. Conclusions: There is significant difference in the water related diseases suffered by vended water consumers among the various wards of the study area. It is strongly recommended that sanitation awareness be created in the study area starting with wards that have higher incidences of water-related diseases, and improved local technologies be employed for drinking water purification and treatment. It is also being recommended that where vendor supplies are not taken from utility pipe supplies, routine testing and sanitary inspection is desirable.

Abstract Number	**P-1-14-10**
Presenter	Dianne Lowe, Bertil Forsberg*
Exposure	water
Health domains	other
Type of research	review

Health vulnerability risk factors before, during and after floods

Background: Floods are the most significant form of all natural disasters, in terms of the number of persons affected, and flash floods result in the highest average mortality per event. We sought to identify factors that increase vulnerability to morbidity and mortality of flooding events, pre-, during and post- (short and long term) event. Identifying factors that increase vulnerability to health impacts may aid the appropriate targeting of flood related adverse health prevention strategies. Aims: to determine the risk factors that increase individual vulnerability to the health impacts of floods with a focus on Europe. Methods: We undertook a review of factors that increase vulnerability to the human health effects of floods. We searched pubmed for “flood”, “risk factors” and related terms. We additionally searched the internet and the citation listings of relevant publications. Results: We present the research focusing specifically on flood-health vulnerability or identifying risk factors that increase flood related fatalities. Where research does identify risk factors increasing flood morbidity or mortality vulnerability it predominately focuses along demographic characteristics such as age and gender. The literature suggests that both physiological (injury, illness, mortality) and psychological (anxiety and depression) are the common flood related health impacts. Common causes of death include drowning (especially car related), cardiac events, asphyxiation, electrocution, physical trauma and fire. Conclusions: The research suggests that the psychological and physiological health effects of floods may be disproportionately borne by males and elderly individuals. However very few studies were designed to determine the vulnerability factors associated with health effects of flood events. Studying the impacts of floods poses strong methodological issues, which is reflected in the available research.

Abstract Number	**P-1-14-11**
Presenter	José Rodriguez-Llanes*, Shisir Ranjan-Dash, Laura Irvine, Debarati Guha-Sapir
Exposure	water
Health domains	other
Type of research	cross-sectional study

Increased risk of malnutrition among flood-exposed children of rural eastern India: results from a population-based survey

Background The relationship between exposure to floods and child malnutrition is poorly understood. Research has focused exclusively on Bangladeshi children, and few controlled epidemiological studies are available. Aim To investigate the association of flood-exposure and child malnutrition in rural communities. Methods We carried out a cross-sectional nutritional survey in Jagatsinghpur, a coastal district of the state of Orissa, India. The sample was obtained using a two-stage cluster design, with villages and children as primary and secondary sampling units respectively. Probability Proportional to Size (PPS) sampling was used at first stage and simple random sampling at second stage of selection. Field work was carried out between the 6th and 24th of September 2009, approximately one year after last severe floods ocurring in September 2008. Half of the sample of children was obtained in flood-exposed villages and the other half in nearby unexposed ones. Out of the 900 children selected, 879 were measured and weighted and a total of 871 heads of households were interviewed face-to-face for the collection of additional background data on social, economic and health variables. The prevalence of stunting, underweight and wasting, based on the new 2006 WHO standards, were calculated to evaluate the nutritional status of children. Prevalence ratios were applied to investigate the main risk factor, controlling for possible confounders. All analyses were conducted using R software. Results A three-times higher prevalence of wasting was found in flood-exposed-children, compared to those living in unexposed communities. These results were similar in unadjusted and adjusted analyses. Conclusions These preliminary results reflect the mid-term nutritional impacts of the exposure to floods in children aged 6 to 59 months. These findings stress the need to increase resilience and provide longer-term support to these communities, especially in the face of ongoing global environmental change.

Abstract Number	**P-1-14-12**
Presenter	Lucas A. Salas*, Cristina M. Villanueva, Salman M. Tajuddin, André F. S. Amaral, Agustín F. Fernandez, Nathaniel Rothman, Debra T. Silverman, Kenneth P. Cantor, Manolis Kogevinas, Mario F. Fraga, Núria Malats
Exposure	drinking water
Health domains	cancer
Type of research	case-control study

LINE-1 methylation, lifetime trihalomethane exposure from drinking water and bladder cancer risk

Background: DNA methylation regulates gene transcription. Hypomethylation has been linked to bladder carcinogenesis. Trihalomethanes (THM), a class of disinfection by-product in chlorinated water, are associated with increased urothelial bladder cancer risk. In animal models THM exposure is associated to hypomethylation. To our knowledge there is no human evidence evaluating the joint effect of THM and methylation on bladder cancer. Aims: We aim to evaluate the association between THM exposure and global DNA methylation (GDM) in controls, and to evaluate the modification of bladder cancer risk associated with THM exposure by GDM. Methods: Personal historical residential THM levels, and blood samples were obtained from 548 incident urothelial bladder cancer cases and 559 matched hospital controls in Spain. LINE-1 GDM, estimated as average percentage of 5-Methyl Cytosine (5MeC%) of four CpG in the promoter region, was determined by pyrosequencing in leukocyte DNA. Statistical models included beta and logistic regression. Effect modification was explored through stratified analyses and tests for statistical interaction. Results: Among controls, 5MeC% showed a bimodal distribution, cut at 64%; and was not associated with THM levels. In stratified models, subjects with 5MeC% ≤64% showed a monotonic increase in bladder cancer risk with increasing THM levels. Using as reference the first quartile (Q1), adjusted odds ratios (OR) per quartile were: OR(Q2) 1.71 [1.03-2.83], OR(Q3) 3.08 [1.74-5.45], and OR(Q4) 2.55 [1.19-5.5], p-trend=0.002. In contrast, subjects with 5MeC % above 64% did not show an association with bladder cancer risk, p-trend=0.433 (p-interaction=0.021). Conclusion: For the first time to our knowledge, the joint effect of GDM and THM exposure with bladder cancer was explored in humans. In our data, GDM is unrelated to THM levels among controls, but it modifies the bladder cancer risk associated with THM levels. Results are consistent with experimental evidence.

Abstract Number	**P-1-14-13**
Presenter	Sophie Haesen*, Thomas Fürst, Jürg Utzinger
Exposure	drinking water
Health domains	infectious diseases
Type of research	review

Noma: epidemiology and global burden of a neglected disease

Background: Noma (cancrum oris) is a disfiguring gangrenous disease causing severe facial tissue destruction, stigmatization and even death. Noma almost exclusively occurs in young children living in remote areas of the least developed countries. Aims: To systematically review the literature and consult with experts to obtain epidemiological data of noma and estimate its global burden, as expressed in disability-adjusted life years (DALYs). Methods: We undertook a systematic review (PubMed, ISI Web of Science, SIGLE) to identify articles providing data on morbidity and mortality of noma. Noma experts were consulted to complement our literature search. To measure the number of years lost due to ill-health, disability or premature death, we calculated DALYs using a simplified disease model. Results: Our review revealed that the epidemiology of noma is poorly understood, but it is clear that several factors linked to the environment play a role. Among these are the lack of access to clean water and residential proximity to livestock. Malnutrition, a compromised immune system and poor oral hygiene are additional factors. If diagnosed early, treatment for noma is relatively straightforward, effective and inexpensive. Improved diet of malnourished children, access to clean water, and education considerably lower noma-related morbidity and mortality.Ignorance, the inability of patients to reach treatment facilities in time, and the perception of noma as a shame explain the paucity of epidemiological data. While noma was included in the World Health Report 1998, it was neglected in the subsequent Global Burden of Disease Study. The available epidemiological data plus the use of a simplified disease model allowed us to calculate the first DALY figure that will be presented. Conclusions: The 1997 estimates of noma morbidity and mortality put forward by the World Health Organization were primarily based on expert opinion. The new insight into the epidemiology of noma presented here and the first global burden estimates reflect noma's impact more appropriately.

Abstract Number	**P-1-14-14**
Presenter	Cyril Catto*, Sabrina Simard, Ginette Charest-Tardif, Sami Haddad, Manuel Rodriguez, Robert Tardif
Exposure	drinking water
Health domains	respiratory disease
Type of research	exposure measurement

Occurrence and speciation of disinfection by-products in water and air of indoor swimming pools in the province of Quebec (Canada)

Swimming pools' workers are exposed to potentially high levels of water and air disinfection by-products (DBP) which actual health impacts (e.g., irritation, carcinogenicity, genotoxicity) are still unclear. In the course of a project intended to assess occupational exposure to these contaminants, we conducted a study aimed to measure both typical and emerging DBPs in 41 indoor pools (14 in Quebec City and 27 in Montreal). Each pool was visited once, usually during the times of public swim. They were investigated for i): water levelsof 6 Haloacetic acids (HAAs), 4 Trihalomethanes (THMs), 4 Haloacetonitriles (HANs), Chloropicrine (CPK), 2 Haloketones (HKs), and ii) air levels of Chloramines (CAM) and THMs. Overall, nearly 900 samples and 3500 analyses were carried out for this study. Water emerging DPBs, including HANs, CPK and HKs, were found in substantial levels compared to their concentrations into drinking water network, especially HANs which were approximately 10-times higher (mean±SD: 21.4±13.9µg/L). HAAs showed the highest levels (295±157µg/L), which is consistent with previously reported high accumulation of these non-volatile compounds in pool waters. While chloroform (TCM) is usually the most abundant THM in both water (37.9±25.7µg/L) and air (119.4±74.2µg/m3), we measured important levels of brominated THMs in both media in 18 swimming pools. Interestingly, in 9 of these swimming pools, the brominated THM levels were even predominant (75.7±23.0µg/L in water and 223.7±101.8µg/m3 in air). Air CAM levels vary highly between each pool (0.23±0.14µg/m3). Preliminary statistical analyses disclosed relatively good correlations between air and water levels for TCM (R= 0.66) and THMs (R= 0.60). This study will be followed in next months by a second campaign to assess worker's exposure through biological exposure monitoring. [Supported by IRSST, Québec]

Abstract Number	**P-1-14-15**
Presenter	Benny Chefetz, Tomer Malachi*, Galit Tadmor, Myah Goldstein, Moshe Shenker
Exposure	persistent organic pollutants
Health domains	healthrelated quality of life
Type of research	exposure measurement

Pharmaceutical and Personal Care Products (PPCPs) in Soils Irrigated with Treated Wastewater (TWW): Uptake by Crops and Exposure

Background Irrigation with treated wastewater (TWW) accounts for about 50% of total irrigation water in Israel. This unique situation of intensive irrigation with TWW containing pharmaceutical and personal care products (PPCPs) provides an excellent opportunity to study the long-term exposure effects of these compounds in the agro-environment. The long-term introduction of PPCPs to arable land may affect the agro-ecosystem in various aspects which are not known to date. Guidelines regarding the quality of TWW for crop irrigation mainly consider the hygienic quality of the water and the level of elements that may have adverse effects on plant and soil. In the common standards for TWW, no attention is given for PPCPs and endocrine disrupting compounds. Aim In this paper, we highlight possible pathways by which PPCPs may enter the food-chain due to crop irrigation with TWW. Results PPCPs were detected in TWW in mg/L to ng/L range. PPCPs were also detected in soils irrigated with TWW at a level of low ng/g soil. Neutral PPCPs were mainly accumulated in the topsoil enhancing the ability of uptake by crops through the roots. Greenhouse and field experiments indicate that PPCPs can be taken up and bio-accumulated from their indigenous concentration in TWW. PPCPs concentrations in fruits and leaves of vegetables were affected by the soil's properties. Our experimental data suggest that the uptake of PPCPs can be considered as passive and that translocation within the plant is governed by water mass flow. Therefore, the bioaccumulation factor for the fruits was significantly lower than that of leaves. Conclusions This study emphasizes the potential uptake of PPCPs by crops in soils irrigated with TWW and highlights the potential risks associated with this agricultural practice. This study suggests high exposure potential for this emerging group of contaminants via leaf crops such as lettuce, parsley, cabbage and others.

Abstract Number	**P-1-14-16**
Presenter	Anna Augustsson*
Exposure	drinking water
Health domains	other
Type of research	exposure modeling

Probabilistic exposure assessment challenges the safety margin in drinking water criteria – the example of fluoride

Regulations in the permitted levels of potentially harmful substances in drinking water are given to secure that people are not exposed to levels were negative effects may occur. The maximum permitted concentration is obtained by searching for an exposure level that matches the tolerable daily intake (TDI). The applicability of any kind of health criteria require that these criteria are based on conservative exposure estimates. However, exposure assessments contain large uncertainties, which have to be described in order for one to decide where the optimal level of caution is. This study provides an exposure assessment of an element – fluoride - where water consumtion is commonly recognized as the main exposure pathway. Exposure through beverages, solid food, dental products, soil ingestion and inhalation of dust is also considered. Calculations were probabilistic, hence using indata as intervals or probability distributions and hence resulting in a probability distribution of the total exposure, which could be compared with suitable guideline values. The most commonly used guideline value for fluoride is the WHO drinking water criteria of 1.5 mg/L. When multplied with average daily water intake and corrected for average bodyweight, the daily exposure corresponds well to the US EPA TDI value of 0.06 mg/kg-day. However, when considering variability in body weight and water consumption, it is shown that about half of those consuming water with 1.5mg F/L exceed the TDI value, and this fraction increases significantly when the additional exposure pathways are included. In this case, the reference values referred to are set to avoid dental fluorosis, which can be considered a cosmetic defect rather than a traditional health problem. However, what this example shows is that by not accounting for uncertainty and variability in exposure assessments, there is a risk for misjudgement of health- or environmental criteria.

Abstract Number	**P-1-14-18**
Presenter	Mutasem El-Fadel, Rania Maroun, Mirna Alameddine, Darine Mawla, Sophia Ghanimeh*
Exposure	drinking water
Health domains	costs
Type of research	others

Social Cost Benefit Analysis of Water and Sanitation Improvement in a Poor Urban Slum

Background: Lack of access to safe water supply and adequate sanitation services is a major cause of diarrhea in poor urban slums, directly affecting to the livelihoods and incomes of the poor residents by impacting their health and ability to earn. Aims: This paper compares the economic feasibility of implementing interventions to improve water quality at the point of use in a poor urban slum, where the prevalence of water-related diarrhea was estimated at 33% and where increased morbidity and premature mortality impose a socio-economic burden on the local population of 3.4 to 17.1% of area annual income. Methods: Five household intervention alternatives were identified for water quality improvement in a poor urban slum, including replacing deteriorated attic water tanks with rooftop tanks, replacing water piping, replacing wastewater piping, and a combination of these interventions. A social cost-benefit assessment (SCBA) was conducted to evaluate and compare these alternatives under 6 scenarios that combine the ranges of minimum to maximum costs with those of minimum to maximum benefits. The costs were based on capital and operational expenditures while the benefits considered averted morbidity and premature mortality, using various economic tools including the Cost of Illness, the Averted Behavior, and the Disability Adjusted Life Years approaches for morbidity valuation, and the Human Capital Approach for mortality valuation. The applied SCBA methods included the Benefit/ Cost ratio, the Net Present Value, and the Return on Investment. Results: The SCBA revealed that installing rooftop tanks and replacing water piping at the household were the most economically viable interventions, with a Benefit/Cost ratio ranging between 4.6 and 16.8 USD for every 1 USD invested. These alternatives also exhibited a positive return on investment within a maximum of 10 years from implementation. Thus, simple low cost interventions are expected to result in positive health impacts which translate into a significant positive socio-economic impact in a poor urban slum.

Abstract Number	**P-1-14-19**
Presenter	Levterova Boryana*, Donka Dimitrova, Milena Kolarova, Tanya Uchordjieva, Elena Dragova
Exposure	water
Health domains	infectious diseases
Type of research	others

Study of Hepatitis "A" Outbreak in a rural community in Southern Bulgaria

Background: The hepatitis A virus is one of the most frequent causes of foodborne infection in Bulgaria. Public health interventions that prevent mortality and morbidity have greatly increased over the past decade. Immunization is one of these preventive interventions, with a potential to bring economic benefits beyond just health benefits. Aims: To identify the possible risk factors associated with the occurrence of outbreak of hepatitis A in rural community in Bulgaria and provide recommendations for control and prevention of the disease and to prevent its recurrence. Methods: This study investigated an outbreak of viral hepatitis A in a rural community of Iscra, a small villagein SouthernBulgaria, during January-March 2012. Hundredtwenty-six blood samples, 10 water samples and 42 food samples were collected. Serum samples were tested for IgM and IgG anti HAV and IgM and IgG anti HEV antibodies. Results:125 people are infected with 69 men (86.25%) and 56 women (13.75%). at a large number of infected in age group 15-19 years (28.75%), followed by 5-9 years (18.74%). The epidemic curve showed occurrence of a peak every 4 to 6 weeks.The identified risk factors was contact with jaundice case (OR = 2.46, 95% CI = 1.39-4.36) and this risk increased further in the group of close relatives (OR = 7.79, 95% CI = 1.10-67.13). Accidents were frequently found in water system supplying drinking water to the village. There were no sewerage system and treatment plant in the village. Five hundred contact persons were followed up and tested, and three hundred and sixty of them were vaccinated. Conclusions: This epidemic is an exacerbation of a common source as well as a person-to-person transmission. Future similar outbreaks could be prevented mainly by water source control. It is necessary to increase the requirements for measures of social and domestic hygiene. It is recommended to conducthealth education, specific immunization and food safety will give the best result for disease prevention.

Abstract Number	**P-1-14-20**
Presenter	Giovanni Arena*, Chiara Copat, Angela Di Martino, Alfina Grasso, Isabella Gallitto, Rossella Fazio, Roberto Fallico, Salvatore Sciacca, Margherita Ferrante
Exposure	drinking water
Health domains	other
Type of research	exposure measurement

Total and pentoxide vanadium in drinking water supplies from volcanic area of Mt. Etna (Sicily, Italy).

Background Vanadium exists in different oxidation states from -1 to +5. It dissolves in natural waters as V(IV) and V(V) which have different nutritional and toxic properties. In groundwater from volcanic areas the concentrations of vanadium achieve high levels. Aims Purpose of our study is to evaluate the concentrations of total vanadium and pentoxide fraction in the drinking water supplies of 21 Etna villages, and estimate the daily intake (DI) of the V(V) in adults and children. Methods We analyzed samples from April 2010 to December 2011, performing total V determination in ICP-MS, and speciation of V(V) in IC-ICP-MS. Then we calculated the DI linked to consumption of water considering an ingestion rate of 2L for adults (70 Kg of body weight, 70 years old), and of 1L for children (16 Kg of bw, 6 ys). Results Among the 21 Etna countries considered, 5 exceed the limit imposed by the Italian Ministerial Decree (M.D. 22Th December 2011) of 140 µg/L, and results range from 179,8 to 187,1 µg/L, instead 10 exceed the 50 µg/L limit imposed by previous M.D. N. 31/2001, with results range from 62,5 to 87,1 µg/L. DI of the V(V) calculated range from 0.0003 in 0.0051 mg/Kg/day in adults and from 0.0006 to 0.01112 mg/Kg/day in children. Conclusion The data in our possession show that the Etna villages with a higher concentration of vanadium (Total and V(V)) in waters supllies located in the western part of the volcano Etna. Till date, WHO have no set a provisional tolerable intake for V(V), the more toxic species, for the lack of consistent data on human toxicity. Only EPA have calculate the reference dose (RfDo – 0.009 mg/Kg/day), but it is referred only to decreased hair cysteine. Our DI results might be useful for future evaluations, when toxicological data on V(V) will be improved for the assessment of risk areas.

Abstract Number	**P-1-14-21**
Presenter	Chun-Yuh Yang*, Shang-Shyue Tsai, Hui-Fen Chiu
Exposure	water
Health domains	cancer
Type of research	case-control study

Trihalomethanes in drinking water and the risk of death from esophageal cancer: does hardness in drinking water matter?

Background: Chlorination is presently the most common procedure used for water treatment globally. Despite the effectiveness of chlorine in preventing morbidity and mortality due to waterborne pathogens, there remains concern regarding possible adverse health effects associated with chronic exposure to chlorination disinfection by-products present in drinking water. Aims: (1) to examine the relationship between total trihalomethanes (TTHM) levels in public water supplies and risk of esophageal cancer occurrence; (2) to determine whether calcium (Ca) and magnesium (Mg) levels in drinking water modify the effects of TTHM on risk to develop esophageal cancer. Methods: A matched case-control study was used to investigate the relationship between the risk of death attributed to esophageal cancer and exposure to TTHM in drinking water in Taiwan. Controls were selected randomly and were pair-matched by gender, year of birth, and year of death. Data on TTHM levels in drinking water were collected from Taiwan Environmental Protection Administration. Information on the levels of Ca and Mg in drinking water was obtained from the Taiwan Water Supply Corporation. Results: Relative to individuals whose TTHM exposure level <4.9 ppb, the adjusted OR with 95% CI for esophageal cancer was 1.02 (0.84-1.23) for individuals who resided in municipalities served by drinking water with a TTHM exposure ≥4.9 ppb. There was evidence of an interaction between drinking-water TTHM levels and low Ca and Mg intake. Conclusions: Our findings showed that the correlation between TTHM exposure and risk of esophageal cancer development was influenced by Ca and Mg levels in drinking water. This is the first study to report effect modification by Ca and Mg intake from drinking water on the correlation between TTHM exposure and risk of esophageal cancer occurrence. Increased knowledge of the interaction between Ca, Mg, and TTHM in reducing risk of esophageal cancer development will aid in public policymaking and standard setting for drinking water.

Abstract Number	**P-1-18-01**
Presenter	Eunae Burm*, Mina Ha, Hojang Kwon, Jong-Han Leem, Hwan-Cheol Kim, Jeesuk Yu, Bo-Eun Lee, Seung-Do Yu
Exposure	metals
Health domains	healthrelated quality of life
Type of research	cross-sectional study

A preliminary study on the association between blood lead, cadmium and mercury and pubertal development in boys aged 6 to 19

The time of pubertal development has historically been used as an indicator of adequate growth. Environmental exposure has been reported to be associated with the pubertal development. There are some reports on the association between lead exposure and delayed pubertal development in girls. However, epidemiologic data in boys are limited. We examined the association between blood lead, cadmium and mercury concentrations and pubertal development in boys aged 6-19 years who participated in the cross-sectional pilot study for the Korean Environmental Health Survey in Children and Adolescents (KorEHS-C).Children and adolescents were recruited from the two regions, industrial and rural areas. Of 199 boys participated, 177 were analyzed in this study after excluding those who were not examined the blood levels of heavy metals. Lead(㎍/dℓ), cadmium(㎍/ℓ) and mercury(㎍/ℓ) was measured in whole blood. Besides obtaining information reported via questionnaire, the pubertal development (Tanner stage) was evaluated by students themselves, graded from 1(not initiated pubertal development) to 5 (fully matured) through visual inspection and self-examination using photographs according to internationally accepted criteria and a Prader orchidometer(for testicular development). We used multivariable logistic regression models to assess associations between blood heavy metals and pubertal development. After adjustment for potential confounders, boys with high blood lead level(1.49-4.03㎍/dℓ, highest tertile) showed a delayed pubic hair growth compared to those with low level (0.67-1.15㎍/dℓ, lowest tertile)(Odds Ratio (OR)=0.15; 95% confidence intervals(CIs)= 0.03-0.90). High blood cadmium level(0.39-1.05㎍/ℓ, highest tertile) also showed a delayed effect on testicular development compared to the low level(0.13-0.27㎍/ℓ, lowest tertile)(OR=0.10; 95% CIs= 0.02-0.92). Blood mercury did not show any significant effects on pubertal development in boys.We found delayed effects of high blood levels of lead and cadmium on the pubertal development in Korean boys.

Abstract Number	**P-1-18-02**
Presenter	Fatima-Zahra Azzaoui*, Hinde Hami, Ahmed Ahami
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Aluminum toxicity and Moroccan children's memory

Background:Low basin's Sebou River or "Gharb plain" (area of our study) located in the North-West of Morocco is one of the most important agricultural and industrial regions of the Kingdom. Unfortunately, the environment of this region suffers from the increase of different polluting human activities. The main sources of this pollution are heavy metals. The toxicity of this kind of pollutant exposes the population, especially children, to serious nervous and behavioral problems. Aims:Measure of the contamination degree of low basin Sebou River's stream water by aluminum, and study the relationship between the memory abilities of children, living in this area, and the pollution of the environment. Methods:Analysis of aluminum in stream water is realized by the ICP-AES and the evaluation of effects of pollution on memory abilities is done using Memory Sub-tests of WISC III (Wechsler Intelligence Scale for Children). Moreover, a questionnaire about some environmental conditions is used. Results: The water analysis shows that the stream water's aluminum level registered in the majority of sample stations exceeded the international standards. Also, the most important percentages of short term (3.03%) and working memory impairments (66.67%) are found among children living in most exposed areas to pollution. Moreover, a significant correlations between the performances of short term memory and building materials ($p < 0.05$), source of pollution near the school ($p < 0.05$) and consumption of well water ($p < 0.001$) are registered. Conclusions: Aluminum is neurotoxic that target nervous system and consequently neurocognitive abilities. This finding shows a possible relation between this kind of pollution and memory impairments. However, deeper investigations are needed to confirm this relationship.

Abstract Number	**P-1-18-03**
Presenter	Rivera-Gonzalez Luis*, David E. Cantonwine, Niladri Basu, Braulio Jiménez-Vélez, Noe Crespo-Hernández, Liza V. Anzalota, Akram N. Alshawabkeh, Jose F. Cordero, John D. Meeker
Exposure	metals
Health domains	reproductive outcomes
Type of research	exposure measurement

ASSESING TRACE METALS EXPOSURE IN WHOLE BLOOD DURING DIFFERENT WINDOWS OF SUSCEPTIBILITY IN PREGNANCY IN PUERTO RICO

Background and Aims Trace metal exposure has been previously associated with adverse pregnancy outcomes. Puerto Rico, which has a high preterm birth rate (~19%) and density of superfund sites, is the setting for a recently developed epidemiological cohort. The aim of this exploratory study was to evaluate exposure to different metals of interest among pregnant women participating in the Puerto Rico Testsite for Contamination Threats (PRoTECT) study. Methods: In a pilot sample of N=53 pregnant women, venous whole blood samples were collected at two time points during pregnancy (16-20th and 28-32nd week of gestation). Analysis of total trace metals was performed using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Results: The geometric mean concentrations and ranges (µg/L, except Pb (µg/dL)) of the measured elements during the first clinic visit were: As 1.35 (0.48-6.80), Cd, 0.47 (0.25-1.03), Cr 0.56 (0.32-1.38), Pb 0.42 (0.19 -1.00), Se 191.4 (141.6-256.0), An 4.19 (2.51 -8.04), Co 0.82 (<LOD -1.84), Mo 1.99 (0.84 – 13.26), Ta 0.04 (<LOD – 0.14), W 0.59 (0.34 – 1.20), Zn 4135 (2481.2 – 5543.2), Mn 9.84 (4.47-21.33). Al, V, Ni, Ti, and U levels were under their respective detection limits. Trace metal geometric mean levels were similar between visits. However, only weak to moderate correlations between visits were observed within women for most metals (coefficients ranged from -0.01 to 0.78), which could have important implications for exposure assessment in epidemiology studies estimating exposure during pregnancy. Conclusions: This is the first study to include a panel of both micronutrients and toxic metals in a Puerto Rican population throughout pregnancy. Future analysis will focus on using questionnaire data to assess predictors of exposure, analyzing other biological media, exploring relationships with adverse pregnancy outcomes, and examining possible metal interactions.

Abstract Number	**P-1-18-04**
Presenter	Tsung-Lin Tsai*, Trong-Neng Wu, Saou-Hsing Liou, Shu-Li Wang
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Assessment of Adult Bone Health by Lead Burden

Background: Lead exposure continues to be an important issue for human health. Previous studies indicated that lead may directly affect osteoblast and osteoclast function, and indirectly influence bone turnover due to kidney dysfunction. Some animal research also demonstrated that lead exposure was associated with decreasing bone mineral density. However, the evidence from the human study is lacking. Aims: Our objective is to investigate the association between lead exposure and adult bone health. Methods: Participants' data (n=439) were drawn from the Nutrition and Health Survey in Taiwan (NAHSIT) for 2005-2008. It was a national survey with high representativeness in Taiwan. Bone health was divided into normal (T-score > -1), osteopenia (T-score between -1 and -2.5) or osteoporosis (T-score < -2.5). We used inductively coupled plasma mass spectrometry (ICP-MS) to analyze urinary cadmium and urinary lead levels. Every participant completed the questionnaire including their education, household income, smoking status, alcohol consumption, diet supplement consumption, and outdoor activity. Results: In multivariable logistic regression, increasing age (OR = 1.07; 95% CI = 1.04-1.10; p < 0.001), former smoker (OR = 2.99; 95% CI = 1.20-7.44; p = 0.01) and high urinary lead level (OR = 1.98; 95% CI = 1.00-3.90; p = 0.04) were found to be associated with osteopenia or osteoporosis. After further stratification by gender, increasing age still associated with osteopenia or osteoporosis in both men and women. High urinary lead level was observed to increase risk of osteopenia or osteoporosis in women (OR = 2.66; 95% CI = 1.01-7.06; p = 0.04), but not in men. Conclusions: The results suggest that women with high urinary lead level have higher risk of osteopenia or osteoporosis.

Abstract Number	**P-1-18-05**
Presenter	Moyeol Kang*, Soo-Hun Cho, Minsang You, Yun-Chul Hong
Exposure	metals
Health domains	respiratory disease
Type of research	cross-sectional study

Association between blood cadmium levels and lung function in the Korean adults.

Background High levels of cadmium exposure are known to cause emphysema in occupationally exposed workers, but little has been reported to date on the association between chronic environmental cadmium exposure and pulmonary function Aims We examined the association between pulmonary function and blood cadmium level in adults. Methods This cross-sectional study evaluated adult participants from the Korean National Health and Nutrition Examination Survey (KNHANES) for 2008–2011. Multiple linear regression was conducted to investigate the association between blood cadmium concentration and the pulmonary function tests such as forced vital capacity(FVC), forced expiratory volume in 1 sec(FEV1) and ratio of FEV1 to FVC(FEV1/FVC) adjusting for age, sex, smoking status and passive smoking. Subjects were stratified into quartiles by their cumulative cadmium exposure rank. We estimated the multivariate-adjusted odds ratios (ORs) for obstructive lung disease (defined as FEV1/FVC<0.7) using logistic regression models with the first quartile of cadmium level as the reference group. Results Total number of the subjects in the analysis was 4,009. The blood cadmium concentrations were significantly associated with pulmonary function test (FVC, beta=-2.066, P-value=0.031; FEV1, beta=-2.810, P-value=0.0036; FEV1/FVC, beta=-0.006, P-value=0.001). As the cadmium levels approached higher quartiles, the ORs for an obstructive lung disease was increased significantly, espatially at smoker(highest OR=4.496, 95% CI 1.737-11.634). Conclusions Environmental cadmium exposures are associated with obstructive lung disease in Korean adults and have synergistic effect on pulmonary functions with smoking.

Abstract Number	**P-1-18-06**
Presenter	Young-Seoub Hong*, Byoung-Gwon Kim, Chang-Hun Yu, Dae-Seon Kim, Kyoung-Mu Lee
Exposure	metals
Health domains	other
Type of research	exposure measurement

Biological monitoring of metal mine residents in Korea

Heavy metal contamination near abandoned metal mines caused health risks to nearby inhabitants and 936 mines were existed in Korea. Aims of this study were to measure human exposure level of environmental contaminants and to evaluated the risk of these inhabitants. From 2006 to 2010, we investigated eight mine areas and paired control areas in Busan and Gyeongnam provinces. Study population were recruited from villages near the mines (n=922) and controls (n=651). We measured heavy metal (cadmium, lead, mercury and arsenic) and early renal impairment indices (β2microglobulin and N-acetyl-β glucosaminidase).Mean ages of mine-exposed groups and control groups were 65.83±12.24 and 64.30±12.85, respectively. Geometric means of exposed group and control group were 1.82㎍/ℓ and 1.35㎍/ℓ in blood cadmium, 2.75㎍/dℓ and 2.75㎍/dℓ in blood lead, 5.01㎍/ℓ and 4.47㎍/ℓ in blood mercury, 2.75㎍/g cr and 1.95㎍/g cr in urinary cadmium, 10.47㎍/g cr and 9.12㎍/g cr in urinary arsenic. β2microglobulinand N-acetyl-β glucosaminidasehad a significant increase by blood and urinary cadmium concentration (p<0.001). This study showed that exposure indices from mine-exposed subjects were significantly higher than controls and increased cadmium level was associated with early renal impairment. We found abandoned mines affects the heavy metal levels of nearby residents and therefore additional health studies on other metal mines were needed.

Abstract Number	**P-1-18-07**
Presenter	Patrick Levallois*, Jasmin Levallois, Eladhji Anassour-Laouan-Sidi, Julie St-Laurent, Pierre Ayotte, Jean-Philippe Lafrance
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Cadmium and Lead Exposure and Chronic Kidney Disease in the Canadian Population

Background. Cadmium and lead are nephrotoxic at high doses but there is uncertainty regarding their effect at low exposure levels. Aims. To evaluate the association between biological exposure to cadmium and lead and the prevalence of chronic kidney disease (CKD) in the Canadian population. Methods. Data were collected during phase I of the Canadian Health Measures Survey (CHMS), which was conducted in a representative sample of adult Canadians between March 2007 and February 2009. Among households selected, 69.6% agreed to participate; the overall response rate for the biological part was 51.7%. Cadmium and lead were measured in whole blood samples by inductively coupled plasma mass spectrometry. Cadmium and creatinine were also measured in spot urine samples. CKD was considered when the estimated glomerular filtration rate (calculated from serum creatinine using the CKD-EPI equation) was <60 ml/min/1.73m2. Data were available for 3517 subjects aged between 20-79 years. Logistic regression was used to compare the results between the group with CKD and the control group without CKD with the exposure measures categorized in quartiles. The following co-variables were adjusted for in the analyses: age, sex, smoking status, alcohol intake, hypertension and diabetes. Results. The prevalence of CKD in the adult Canadian population was estimated at 4.3%. In univariate analysis, there was a link between CKD and blood and urinary cadmium and blood lead. However in multivariate analysis, the only association was with blood cadmium, with the maximum OR found for the highest quartile of blood cadmium compared to the lowest: adjusted OR=2.6 (95% Confidence Intervals: 1.0-7.0). Conclusion. In the Canadian population, there is a positive relationship between blood cadmium and the prevalence of

Abstract Number	**P-1-18-08**
Presenter	Christine Dobson*, Molly Kile, Ema Rodrigues, Sakila Afroz, Hafiza Suchanda, Quazi Quamruzzaman, Golam Mostofa, Mahmuder Rahman, Golam Mahiuddin
Exposure	metals
Health domains	reproductive outcomes
Type of research	exposure measurement

Cadmium biomarker levels in maternal-infant pairs in Bangladesh

Background: Pregnant women and neonates are at higher risk of cadmium (Cd) exposure due to increased caloric intake and physiologic demand for the essential nutrients Fe, Zn, and Ca, which are metabolized similarly to Cd. However, few large studies have explored Cd exposure in pregnant women and Cd fetal transfer. We characterized Cd exposure among Bangladeshi pregnant women using 3 maternal biomarkers (urine, hair, and nail) and 3 neonatal biomarkers (cord blood, infant hair, and infant nail). Aims: To measure Cd levels in pregnant women and neonates and evaluate how levels relate among biomarker types and sample times. Methods: 569 women were enrolled during their first trimester and followed until one month postpartum. We collected spot urine samples in the first and third trimesters, hair and nails in the first trimester and at one month postpartum, cord blood at delivery, and infant hair and nails at one month. All biomarkers were analyzed for Cd via ICP-MS. We computed descriptive statistics of Cd levels and Spearman correlation coefficients to describe relationships between repeated measures and between biomarker types. Results: There were no differences in Cd levels between the biomarker repeated measures. Maternal hCd levels were well correlated (0.69, p<0.001), while uCd (0.35, p=0.002) and nCd levels (0.34, p<0.001) were moderately correlated. Half of all cord blood samples had detectable levels of Cd. The median cbCd level (0.51 ug/L) is among the highest reported. Cord blood Cd was weakly negatively correlated with first (-0.18, p=0.003) and second (-0.16,p=0.008) maternal nCd and with infant hCd (-0.29, p< 0.001). Conclusions: Elevated levels of cbCd suggest that fetal exposure to Cd occurred despite the ability of the placenta to bind Cd and restrict fetal transfer. Maternal hCd and nCd levels tracked well with each other but did not correlate with uCd levels. More than one urine sample may be needed to accurately characterize maternal uCd during pregnancy.

Abstract Number	**P-1-18-09**
Presenter	Sally Thurston, David C. Bellinger, Chitra Amarasiriwardena, Susan A. Korrick*
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Cord blood manganese and teacher-reported ADHD-related behaviors among 8-year old children

Background: Manganese (Mn) is a naturally occurring metal to which humans are commonly exposed. Though an essential nutrient, exposure to high levels of Mn is associated with neurotoxicity. Animal studies show alterations in dopaminergic function in relation to high neonatal Mn levels, providing evidence for a potential link with Attention Deficit Hyperactivity Disorder (ADHD). Aims: To investigate the association of cord blood Mn with teacher-reported ADHD-related behaviors among children at 8 years of age. Methods: We enrolled 788 mother-infant pairs in a prospective birth cohort. Children were born 1993-1998 to mothers residing adjacent to a metal- and PCB-contaminated harbor in New Bedford, Massachusetts. We measured umbilical cord blood Mn levels using inductively coupled plasma-mass spectrometry (ICP-MS) and fit multivariable regression models to estimate associations with teacher-reported inattentive and impulsive/hyperactive behaviors for 538 children at 8 years of age using the Conners' Rating Scale (CRS). We also explored effect modification by postnatal blood lead levels and by sex. Results: Median (range) cord blood Mn level was 3.97 (0.45-22.15) µg/dL. Associations between prenatal Mn and CRS inattentive and impulsive/hyperactive behaviors were null (adjusted risk ratio (RR) for mild to markedly atypical vs. typical behavior for the highest vs. lowest Mn quartile = 1.0; 95%CI: 0.6, 1.6 and 1.2; 95% CI: 0.6, 2.3, respectively). We did not observe effect modification by prenatal or postnatal lead exposure. We did detect notable differences by sex, with females at higher risk for inattentive behaviors (adjusted RR for mild to markedly atypical behavior for the highest vs. lowest Mn quartile = 1.8; CI: 0.9, 3.6). Conclusions: Prenatal Mn was not associated with ADHD-related behaviors at 8 years, though we did find suggestive associations for Mn and inattentive behaviors among females.

Abstract Number	**P-1-18-10**
Presenter	Soo Eun Chung*, Hae-Kwan Cheong, Eun-Hee Ha, Boong-Nyun Kim, Mina Ha, Yangho Kim, Yun Chul Hong, HyeSook Park
Exposure	metals
Health domains	reproductive outcomes
Type of research	cohort study

Effect of Prenatal Blood Manganese Level

Manganese(Mn) is an essential trace element and common contaminant of food, water and air. Prenatal Mn exposure during gestation may cause the fetus and infancy's neurodevelopment and neurological signs. Excessive exposure of manganese has been associated with toxicity in neurological, pulmonary and reproductive systems. However, report on Mn in the early stage of human exposure to Mn and young children's growth development is rare. Aims In this study, we investigated the relationship between the effect of prenatal manganese exposure on fetal and children's growth from a birth cohort in KOREA. Methods We analyzed data from the birth cohort from Mothers and Children's Environmental Health (MOCEH). The study population included 324 pregnant women in the third trimester. We measured biparental diameter (BPD), abdominal circumference (AC) and femur length (FL) using fetal ultrasound. After birth, children's body weight and height were measured at delivery, 6, 12 and 24month. The relationship between prenatal Mn exposure and growth factors was assessed using linear regression and generalized linear poisson model. Results The mean level of maternal Mn level was 22.3 μg/L (S.D: 6.5 μg/L). Except for prematurity (＜38 weeks), a total of 342 mother-infant's data were used. The peak level of blood Mn was found to be associated in the range of 23.0~25.0 μg/L and then decreased body weight and height's peak level(25.0~28.0 μg/L) were higher than the weight. Conclusions The results of the study showed that prenatal manganese exposure has both positive and negative impacts on fetal growth and development. Depending on the level while no cut off point has been established to define Mn poisoning, high blood Mn levels were associated with adverse development in the fetus.

Abstract Number	**P-1-18-11**
Presenter	Diana Maria Caicedo-Borrero*, Fabián Méndez Paz
Exposure	metals
Health domains	other
Type of research	cohort study

Effects of lead and cadmium in physical growth in a cohort of children 0-2 years of age in Cali-Colombia

Background: Exposure to heavy metals during fetal development is one determinant of perinatal and child health. In Cali, in a follow-up study in pregnant women (Cohort "GEMA") we have documented women prenatal exposure to lead (Pb) and cadmium (Cd) and effects in fetal growth and low birth weight. Objective: The objective of this study was to characterize the exposure of infants of the cohort, to assess their effects on physical growth at two years and occurrence of interactions between prenatal and postnatal exposures. Methods: In a cohort study of pregnant women, we measured Pb and Cd in whole blood during first and third trimesters, and measured umbilical cord blood at delivery in 162 newborns. Follow-up included: surveys to characterize risk behaviours and habits of mothers, their partners and children. Finally, we measured weight and height of children every 12 months. Results: At first trimester, maternal lead and cadmium medians were 1.10 (0.00-16.1), and 0.20ug/dl (0.01-4.2), correspondingly; while at third trimester, were 0.94(0.00-27.95) and 0.14ug/l(0.01-7.08). At birth, lead median in umbilical cord blood was 1.6ug/dl((<DL-12.6) while cadmium was 0.30ug/l(<DL-2.79). Maternal blood lead concentrations were predictors of lead levels in umbilical cord blood. Additionally, para-occupational exposures during prenatal stage were predictors of lead and cadmium levels in umbilical cord blood ($p<0,05$). An increase in umbilical cord blood lead (1 ug/dl) was associated with a 123,1 g decrease in weight ($p<0.06$) in children. Conclusions: Infants of mothers para-occupacionally exposed in Cali are exposed to heavy metals. Our results suggest that lead exposure affect children early physical growth.

Abstract Number	**P-1-18-12**
Presenter	Isabella Karakis*, Daniella Landau, Maayan Yitshak-Sade, Doron Dukler, Reli Hershkovitz, Michal Rotenberg, Batia Sarov, Itamar Grotto, Lena Novack
Exposure	metals
Health domains	reproductive outcomes
Type of research	cross-sectional study

Exposure to metals and congenital anomalies: a biomonitoring pilot study in pregnant women in Southern Israel

Background: Bedouin population in the Southern Israel is of low socio-economic status and many still dwelling in tribal settlements. Cooking and heating is often conducted with open fire, in addition to the air-pollution from the local industrial park (IP). Smoking among males and consanguineous marriages are frequent. Previous ecological study showed elevated rates of major malformations within Bedouin population residing near the IP compared to remote localities (5.6% vs. 4.8%, respectively, $p<0.01$). High ambient values of Arsenic and Nickel were detected based on monitoring reports. Exposure to metals has been related to birth defects, mostly shown on animal models. Aims: We aimed to estimate the extent of exposure to metals in pregnant Bedouin women in relation to their birth outcomes. Methods: We enrolled 60 Bedouin women upon their admission to delivery room of a local hospital, where maternal urine samples were collected and maintained at -20C in sterile conditions till tested for metals in the lab of Clinical Toxicology at the Sheba Medical Center, Tel-HaShomer. Metals tested at delivery reflect exposure during pregnancy. The information on pregnancy, consanguineous marriages, and parental exposures was collected from a hospital computerized registry and an interview. Results: Aluminum was detected in 5 out of 30 women (16.7%), Arsenic - in 6 out of 60 women (10.0%) and Nickel in 1 (1.7%), amounting to 10 women (16.7%) positive to any of the 3 metals. Cadmium was under detection level (1 mg/l), in spite of a high rate of smoking among Bedouin males, indicating low maternal passive-smoking exposure. Three out of 10 fetuses exposed to metals (30%) had anomalies and 1 fetus died in utero, compared to 16.0% (8/50) with anomalies within the unexposed group. Mothers exposed to metals tended to live closer to IP, their newborns were born earlier and at a lower weight (pv=0.06). Conclusions: Our findings urge for further screening for metals in susceptible populations in Israel.

Abstract Number	**P-1-18-13**
Presenter	Catharina Wesseling, Norbel Roman, Laura Paez, Vilma Garcia, Indiana Quiros, Ana Maria Mora*, Jorge Juncos, Kyle Steenland
Exposure	no exposure
Health domains	neurodegeneration
Type of research	others

Feasibility for screening for Parkinson's and Alzheimer's disease in Costa Rica

Background: Parkinson's disease (PD) and Alzheimer's disease (AD) are the most common neurodegenerative diseases in the world, but no country screens for these diseases. Aim: To assess the feasibility of a screening program for neurodegenerative diseases among Costa Rican elderly. Methods: Subjects aged ≥65 from two primary health care clinics participated in a 3-step screening protocol. Step 1 included two questions about tremor-at-rest and balance, a spiral-drawing test, and a 3-word recall and animal category fluency tests. Step 2, administered to those who failed Step 1, comprised of a 10-item version of the Unified Parkinson Disease Rating Scale (UPDRS) and the Mini-Mental State Examination (MMSE). Step 3 included a complete neurological evaluation of those who failed Step 2, which resulted in diagnoses of PD, AD, mild cognitive impairment (MCI), other disorders, or healthy. Results: Four hundred one subjects (80% of eligible population) were screened; 370 (92%) failed Step 1, 163 (45%) failed Step 2, and 81 (56%) were diagnosed with a neurodegenerative disease in Step 3. Out of these 81 individuals, 33 were diagnosed with PD, 20 with AD, and 35 with a combined diagnosis of MCI and PD or AD. Ninety percent of the diagnosed cases had not been identified previously. Prevalence of PD was 3.7 times higher than expected based on international data, and prevalence of AD was close to the expected. Step 1 motor and cognitive tests had high sensitivity (93% for both) and low specificity (23% and 29%, respectively) in relation to Step 2 results. Step 2 tests had also high sensitivity (100% for UPDRS, 96% for MMSE) and acceptable specificity (76% and 94%) in relation to final diagnoses of PD and AD/MCI. Conclusions: The implementation of a screening program for neurodegenerative diseases in Costa Rica's public health care system is feasible. However, adjustments in the cut-off points for the UPDRS and 3-word recall test need to be done in order to improve test specificity.

Abstract Number	**P-1-18-14**
Presenter	Rajashekar Rao Barkur*, Laxminarayana K Bairy
Exposure	neurotoxin
Health domains	neurodegeneration
Type of research	others

Histological Study On Hippocampus Following Low Lead Exposure During Prenatal And Postnatal Brain Development In Rats.

Background: Neuropsychological studies in children who are exposed to lead have confirmed its detrimental effects on behavioral and cognitive development. However there is inconsistency in information on the crucial period of brain development as far as lead neurotoxicity is concerned. Aims: To assess the cellular damage in hippocampus of rat pups exposed to lead during different periods of early brain development. Methods: Four groups of rat pups were investigated. (a) control group (n=6) (mothers of these rats were given normal drinking water throughout gestation), (b) Gestation lead exposed group (n=6) (exposed to 0.2% lead acetate in the drinking water through the mother throughout gestation [gestation day 01 to day 21]), (c) Lactation lead exposed group (n=6) (exposed to 0.2% lead acetate in the drinking water through the mother throughout lactation [postnatal day 01 to day 29]), (d) Gestation and lactation lead exposed group (n=6) (exposed to 0.2% lead acetate throughout gestation and lactation). On postnatal day 30, rat pups of all the groups were sacrificed. Numbers of surviving neurons in the CA3 and dentate gyrusregions of hippocampus were counted following cresyl violet staining. The significance of differences among the groups were assessed using one way analysis of variance (ANOVA) test followed by Bonferroni multiple comparison test.P values < 0.05 were considered as significant. Results: Hippocampal histological data indicate that lead exposure caused significant damage to neurons of CA3 and dentate gyrus in all lead exposed groups and the extent of damage to neurons of CA3 and dentate gyrus of Lactation group was comparable to Gestation and lactation group. Conclusion: Postnatal period of brain development seems to be more vulnerable to lead neurotoxicity as it had shown significant hippocampal damage even though period of exposure was less compared to Gestation and lactation group.

Abstract Number	**P-1-18-15**
Presenter	Lian Liu*, Xijin Xu, Kim Dietrich, Xia Huo
Exposure	metals
Health domains	mental health
Type of research	case-control study

Influences on Thyroid Hormone Concentrations and Mental Development of Children Co-exposed to Lead and Cadmium

Background: Thyroid hormones (THs) can influence the metal development of fetus and neonate. Recently studies have shown lead (Pb) and cadmium (Cd) also could affect mental development of children. But the associations among them have not been well studied. Objects: To establish possible associations among THs, co-exposure to Pb/Cd and impaired mental development of children. Method: We investigated a total of 258 children in Guiyu and control group. Concentrations of free triiodothyronine (FT3), free thyroxine (FT4), the third generation of hypersensitivity of thyrotropic hormone (TSH3UL), Pb and Cd in blood were determined. Children were assessed using the Bayley Scales of Infant Development, 3nd edition (BSID-Ⅲ). Cognitive and language scores were combined (combined Bayley-III score [CB-III scores]) for mental development assessment. We estimated the possible associations among them. Results: Median values of Pb and Cd in Guiyu were higher than that in the control area (11.30±5.38μg/dL vs. 5.77±2.51μg/dL; 1.22±0.55μg/dL vs. 0.72±0.37 μg/dL, P=0.000), and the mean values of FT4 and TSH3UL in Guiyu were significantly higher than those in the control area (16.65±1.830 pmol/L vs.16.057±1.661pmol/L, P=0.007; 2.792±1.300mIu/L vs. 2.210±1.430mIu/L, P=0.001, respectively). CB-III scores of Guiyu children were 15% lower than children from the control area (197±33 vs. 232±23, P=0.000). Conclusion: Exposure to the dismantling industry in an e-waste recycling site may contribute to high levels of Pb and Cd in the blood of local children, impacting child health. The neurotoxic impact of Pb exposure may occur in these children, accompanied by abnormal TSH3UL levels.

Abstract Number	**P-1-18-16**
Presenter	Kelly Bakulski*, Sung Kyun Park, Marc G Weisskopf, Katherine L. Tucker, David Sparrow, Avron Spiro III, Pantel S. Vokonas, Linda Huiling Nie, Howard Hu, Jennifer Weuve
Exposure	metals
Health domains	cardiovascular disease
Type of research	cohort study

Lead exposure, B-vitamins, and plasma homocysteine in older men

Background: Risks for cardiovascular and neurodegenerative disease known to be associated with homocysteine, a one-carbon metabolite, may be influenced by lead exposure. Longitudinal studies and studies of the interplay of lead exposure and dietary factors are lacking. Aims: To examine the longitudinal association of recent and cumulative lead exposure with homocysteine concentrations and the potential modifying effect of dietary intake of nutrients involved in one-carbon metabolism. Methods: In a subcohort of the VA Normative Aging Study (1,056 men with 2,301 total observations between 1993 and 2011), we used mixed effects models to estimate differences in repeated measures of total plasma homocysteine across concentrations of lead in blood and tibia bone, assessing recent and cumulative exposure, respectively. We also estimated differences in rate of change in homocysteine over time associated with blood and bone lead concentrations. Results: Higher exposure to lead was associated with higher homocysteine. An interquartile range (IQR) increment in recent blood lead concentration (3-µg/dl) was associated with 6.3% higher homocysteine concentration (95% confidence interval (CI): 4.8 to 7.8). An IQR increment in cumulative tibia bone lead concentration (14-µg/g) was associated with 3.7% higher homocysteine (95% CI, 1.6 to 5.6), which diminished when we accounted for blood lead. For context, in our data, homocysteine levels increased by 5.7% with 5 years of aging. The association between blood lead and homocysteine was significantly stronger among participants with lower v. higher dietary intakes of vitamin B6 and folate. Conclusions: Higher levels of lead exposure were associated with elevated homocysteine. Increasing intake of folate and B6 may be an effective way to mitigate lead's effects on homocysteine, and, in turn, cardiovascular disease and neurodegeneration.

Abstract Number	**P-1-18-17**
Presenter	Maria Wallin*, Gerd Sallsten, Lars Barregård
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Low level kidney cadmium and effects on urinary alpha-1-microgloblin

Background: Cadmium (Cd) can cause renal damage after high-level exposure. Recently such effects have been shown also at low-level exposure, as measured by Cd in blood or urine. Using urinary Cd may, however, result in erroneous conclusions. Associations with Cd in kidney biopsies from a healthy population have not been examined previously. As cadmium damages the proximal tubular cells, the reabsorption of low-molecular-weight (LMW) proteins is decreased and results in increased urinary excretion. One of the most commonly used biomarkers linked to cadmium nephrotoxicity is the LMW protein alpha-1-microglobulin (A1M). Aims: The aim of this study was to explore the relation between kidney Cd and urinary excretion of alpha-1-microglobulin in kidney donors, representing the healthy part of the general population Methods: Cd was determined in kidney cortex biopsies from 109 living kidney donors. A1M and creatinine was analyzed in overnight and 24-hour urine samples. Correlations between single variables were assessed by Spearman correlation coefficients. Associations between urinary A1M and kidney Cd and background variables were assessed using multiple linear regression with backward elimination. Results: In spite of relatively low kidney Cd levels (median 13 µg/g, range 1.5-55 µg/g) kidney Cd and urinary A1M were positively associated, with significant correlations both in 24-hour and overnight samples. In multivariate analyses, there were significant associations between kidney Cd and creatinine-adjusted A1M in never-smokers, both in 24-hour and overnight urine, in a model including age, sex and weight. Conclusions: This study provides support for an association in the general population between kidney Cd levels and urinary excretion of A1M, a biomarker for kidney damage. The results further confirm the importance of preventing environmental pollution by cadmium.

Abstract Number	**P-1-18-18**
Presenter	Flavia L Barbieri*, Jacques Gardon, María Ruiz-Castell, Paco Pamela, Rebecca Muckelbauer, Corinne Casiot, Rémy Freydier, Jacqueline Müller-Nordhorn, Thomas Keil
Exposure	metals
Health domains	equity
Type of research	exposure measurement

Metallic trace elements in maternal blood and cord blood in an Andean mining city of Bolivia

Background The Bolivian highlands have held mining activities for centuries, with the resulting environmental contamination. Towns and cities have developed in the surroundings of mines and smelters with poor regulation and little conscience of the risk for human health. Aims Our study aimed to describe the situation of exposure to metallic trace elements (MTE) in pregnant women and their newborns in the mining city of Oruro, Bolivia. Methods We recruited healthy pregnant women from health care facilities and conducted interviews to obtain information about health and socioeconomic status and collected a venous blood sample (n=419). At birth we collected cord blood samples (n=240). Analyses of whole blood samples were performed using inductively coupled plasma mass spectrometry (ICP-MS) to measure Pb, As, Sb, Cu, Se, Ca, Fe and Zn. Median concentrations of MTE were compared by socioeconomic variables and adjusted by pregnancy trimester. We explored correlations between MTE in maternal blood and cord blood. Results Lead (Pb) concentrations were low (median: 19.35 µg/L; IQR: 13.52-27.11 µg/L; range: 4.38-801.60 µg/L) with only 2% women and 2.5% newborns above 100 µg/L. After adjusting for pregnancy trimester, Pb concentrations were higher in women with lower socioeconomic level (p=0.014) and whose husband worked in mining (p<0.0001). Other MTE showed only weak differences by some of the socioeconomic variables on univariate analysis, but none after adjusting by pregnancy trimester. The only clear correlation between maternal blood and cord blood was for Pb (Spearman rho=0.59; p<0.0001). Conclusions Considering the pollution found in this mining town, the adult population does not seem to be highly exposed to MTE. It is possible that the bioavailability of the minerals, mainly in sulfide compounds, is low. Nonetheless, 2% of the population is born with toxic Pb levels and it is necessary to dedicate some efforts to minimize the risk.

Abstract Number	**P-1-18-19**
Presenter	Chen-Cheng Yang*, Hsin-I Chen, Hung-Yi Chuang
Exposure	metals
Health domains	other
Type of research	occupational study

Metallothionein 1A Polymorphisms May Be Associated with Uric Acid Excretion in Chronic Lead-exposed Workers

Background: Lead is a renal toxin, and susceptibility to lead varies between individuals. Metallothionein (MT) is known for its metal scavenging role. Aims: The aim of the study was to evaluate the association among blood lead levels and renal biomarkers in chronic occupational lead-exposed workers and to survey whether the association is influenced by MT1A gene polymorphisms. Methods: In this cross-sectional study, 412 lead-exposed workers participated. Their annual health examination data and renal function markers were collected after the IRB approved the study and consent letters were obtained. From the blood samples, DNA was extracted and used for real-time PCR typing of 2 MT1A SNPs: rs11640851 and rs8052394 on exons 2 and 3. Descriptive analysis, one-way ANOVA, and multiple linear regressions were performed. Results: There was a significant inverted relationship of creatinine-adjusted urine uric acid concentrations and the time-weighted index of cumulative blood lead levels (TWICL) that may be significantly influenced by the AC genotypes of rs11640851 in exon 2 and rs8052394 in exon 3. After controlling for potential confounding factors, the creatinine-adjusted urine N-acetyl-beta-D-glucosaminidase (NAG) concentrations were shown to be influenced by the GG genotype of rs8052394 in exon 3, and were weakly increased with TWICL. Conclusions: We concluded that the variations of MT1A SNPs may influence urine Uric acid and NAG excretion in chronic lead-exposed workers, and urine creatinine-adjusted urine UA as a biomarker of lead toxicity should be considered. Key words: Lead; Metallothionein 1A; Uric acid; Biomarkers.

Abstract Number	**P-1-18-20**
Presenter	Min-ha Han*, Mina Ha, HyeSook Park, Yun Chul Hong, Yangho Kim, Eun-Hee Ha
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Way to prevent Infant's lead exposure through deductive analysis.

BACKGROUND : In this study, we conduct deductive analysis through multivariate analysis of prospective birth cohort data. METHODS : : The prospective cohort study of Mothers and Children's Environmental Health (MOCEH) have been built up in 2006 and we enrolled 1,751 women before second trimester of their pregnancy and their partners in 2006-2010. Participants visited research center at 6, 12, and 24 months. Questionnaires about mother's home environment and health conditions were answered. In order to analyze with various variable, we used the multivariate analysis. When the groups were divided, normality was not satisfied. So, in this case, we used the non-parametric statistical analysis. RESULTS : We found that the residential environment, the mother's medical history, and the parent's smoking showed statistically significant increase to the concentration of lead. In case of using of beds, the concentration of lead was decreased significantly. (p-value : 0.023 < 0.05) However, raising pets and using LPG gas for heating and cooking increased significantly. (p-value : 0.013, 0.007, 0.010 < 0.05) Also, in case of smoking, we found that if mother quits her smoking for short time, it increases infant's concentration of lead however it showed reversely for long time quitting. (p-value : 0.031) Analyzing lead levels of mother and father using canonical correlations, we gained that the 24 months infant's lead concentration was highly correlated with mother's concentration. (Coefficients of mother and father for 24 months are 1.16 and 0.18 respectively) CONCLUSION : We assured that the various causes which increased the concentration of lead of infants through deductive method. This will be used usefully for the preventive strategy from the environment exposures. Keywords : Lead, environment, infants, deductive method, smoking

Abstract Number	**P-1-19-01**
Presenter	Chin-Hsiang Luo*, Hsiao-Chien Huang, Shinhao Yang
Exposure	microbial environment
Health domains	infectious diseases
Type of research	others

Applying the antimicrobial peptide pretreated filters for inactivating bioaerosols

The purpose of this study was to inactivate indoor bioaerosols using carbon nanotube antimicrobial peptide (Hepcidin-25 (HP)) pretreated filters (HPFs). Escherichia coli and λ virus bioaerosols were generated using a Collison nebulizer. The tests were evaluated in a testing column within a filter holder and HPFs.The effect of various factors, including the antimicrobial peptide pretreated concentration, face velocity and relative humidity, on bioaerosol inactivating was examined. The face velocity of the testing column was controlled at 10, 20 and 30 cm/s. Antimicrobial peptide pretreated concentrationsof 0.01 and 0.02 mg/ml were applied to filter microbial pre-contaminated air. The survival efficiencies of E. coli bioaerosols using the untreated filter, 0.01 and 0.02 mg/ml HPF filters were 84%, 50%, and 37%, respectively. The antimicrobial peptide could inactivate bioaerosols. The higher pretreated concentration HPF filter had higher bioaerosol inactivation efficiency than the lower one. The results further demonstrated that the inactivation efficiency decreased with an increasing face velocity. The survival coefficient of 0.01 mg/ml HPF filter forEscherichia coliwas 50%,54% and 57% under face velocity 10, 20 and 30 cm/s. These results indicated that HPF filter is likely to be effective in minimize microbial airborne contamination, especially for poor ventilation space.

Abstract Number	**P-1-19-02**
Presenter	Chun-Chieh Tseng*, Chieh-Chen Cheng
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

Assessment of Bioaerosol Sampling Techniques for Viable Acinetonacter baumannii by Propidium Monoazide Quantitative PCR

Background Acinetobacter baumannii is a Gram-negative coccobacillus, which is frequently associated with nosocomial infections worldwide. Since the introduction of antibiotics, A. baumannii has increased its resistance to broad-spectrum antibiotics and has thus become problematic in intensive care units (ICUs). Although A. baumannii is known to be transmitted by close contact with infected persons, some evidence suggests that airborne dispersal and transmission may also be important. Aims The purpose of this study is to establish the method by using PMA combined with real-time PCR (PMA-qPCR) for rapidly getting the concentration of airborne A. baumannii. Methods The Propidium Monoazide (PMA) is a nucleic acid dye which would be combined with Real-time PCR to determine the viability of bacteria by identifying the integrity of cell membrane. Results We established the method by using PMA-qPCR to detect A. baumannii in the air of our chamber. The PMA concentration used in this study is 10 µg/ml combined with a 500W light irradiation for 3 minutes. Based on the viability test, a linear relationship was observed between culture based method and PMA-qPCR (R=0.99). Consequently, PMA-qPCR has the potential to identify the viability of A. baumannii. The collection efficiency of bioaerosol sampler was evaluated by two parameters in this study; Culturability recovery (CR) and Viability recovery (VR). CR and VR were determined by the culture and PMA-qPCR method, respectively. Our results demonstrated Biosampler and AGI-30 have a batter performance in sampling airborne A. baumannii than the Nuclepore filter, no matter CR or VR was evaluated. Moreover, the stability of PMA binding samples were also evaluated when the samples were stored at refrigerated temperature. Once PMA is binding with A. baumannii DNA, the stability of the DNA bindings was observed to be stable up to 28 days. Conclusions Our study demonstrated PMA-qPCR may be a meaningful method for airborne A. baumannii aerosol detection.

Abstract Number	**P-1-19-03**
Presenter	Saraswathy Manivannan*, Durairaj N, Umamaheswari Sesharamakrishnan, Srinivasan N, Vidhya Venugopal, Padmavathi Ramaswamy, Priscilla Johnson, Sriram Chandramohan, Thangavel Guruswamy, Santu Ghosh, Kalpana Balakrishnan
Exposure	microbial environment
Health domains	respiratory disease
Type of research	cohort study

Assessment of respiratory symptoms and pulmonary function in relation to mold and dampness in South India: Preliminary results from the SICAPHE study

Background: Few efforts have been undertaken to objectively assess respiratory symptoms and pulmonary function in relation to mold and dampness assessments especially in studies from developing countries. We report preliminary results from respiratory assessments in the newly established South Indian Cohort for Air Pollution and Health Effects (SICAPHE) study aimed at generating exposure-response relationships for air pollution, select birth/early childhood outcomes and adult respiratory outcomes. Aim: Assessment of respiratory symptoms and pulmonary function in relation to mold and dampness assessments a rural –urban adult mother cohort in south India. Methodology: We administered a standardised validated questionnaire based on the International Union Against Tuberculosis and Lung Disease's 1984 questionnaire to assess prevalence of respiratory symptoms and performed pulmonary function assessments following protocols developed by the American Thoracic Society for a sub-set adult subjects enrolled in the SICAPHE study (n=444 out of total cohort enrollment of 1200). We performed dampness assessments using questionnaires developed by WHO and characterized 4 types of mold species including Aspergillus, Cladosporium, Penicillium, Alternaria. Results: Initial analyses indicate a prevalence of 28.8 % for mold and 31.6% for dampness. 13.3% of the subjects reported symptoms of wheeze, allergic cough and allergic rhinitis. Pulmonary function decline was significantly associated with higher concentrations of PM 2.5 and presence of mold or dampness. Rural households had a higher prevalence of mold, dampness and higher concentrations of PM 2.5. Rural subjects reported a greater prevalence of respiratory symptoms and lower pulmonary function as compared to urban subjects. Conclusion: The on-going analyses is expected to generate exposure –response relationships for respiratory symptoms and pulmonary function in relation to dampness, mold and air pollution exposure for the SICAPHE study.

Abstract Number	**P-1-19-04**
Presenter	Donguk Park*, Jeong-Kwan Yeom, Won Jae Lee, Kyeong-Min Lee
Exposure	microbial environment
Health domains	healthrelated quality of life
Type of research	exposure measurement

Assessment of the Levels of Airborne Bacteria, Gram Negative Bacteria, and Fungi in Hospital Lobbies

Background: Many of those who pass through hospital lobbies belong to the vulnerable group of weak, elderly, and infirm people, and thus may be very sensitive to biological hazards Aims: We assessed the levels of airborne bacteria, gram-negative bacteria (GNB), and fungi in six hospital lobbies, and investigated the environmental and hospital characteristics that affected the airborne microorganism levels. Methods: An Andersen single-stage sampler equipped with appropriate nutrition plate agar was used to collect the samples. The three types of microorganisms were repeatedly collected at a fixed location in each hospital (assumed to be representative of the entire hospital lobby) from 08:00 through 24:00, with a sampling time of less than 5 min. Temperature and relative humidity were simultaneously monitored. Results: Multiple regression analysis was used to identify the major factors affecting microorganism levels.The average levels of bacteria (7.2 ´102 CFU/m3), GNB (1.7 ´10 CFU/m3), and fungi (7.7 ´10CFU/m3) indicated that all hospital lobbies were generally contaminated. Season was the only factor that significantly affected the levels of all microorganisms ($p < 0.0001$), where contamination was the highest during the summer, significantly higher than during the winter. Other significant factors varied by microorganism, as follows: airborne bacteria (number of people in the lobby, sampling time), GNB (scale of hospital), and fungi (humidity and air temperature). Conclusions: Hospital lobby air was generally contaminated with microorganisms including bacteria, GNB, and fungi. Environmental factors that may significantly influence the airborne concentrations of these agents should be managed to minimize airborne levels.

Abstract Number	**P-1-19-05**
Presenter	Doris Haas*, Herbert Galler, Josefa Luxner, Gernot Zarfel, Walter Buzina, Herwig Friedl, Egon Marth, Juliana Habib, Franz Ferdinand Reinthaler
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Background concentrations of xerophilic fungi and particulate matter in urban air

Aim: In the present study the background spore concentrations of airborne culturable xerophilic fungi and particulate matter of 0.3-10.0 µm were evaluated in the urban air. Also, the concentrations of the most important fungal genera Cladosporium, Aspergillus and Penicillium were measured in relation to the particulate matter. Method: The particle counter APC M3 and the one stage impactor MAS®100 were used for collecting 354 air samples with a flow rate of 100L/min. Airborne xerophilic fungi were collected on Dichloran Glycerol Agar (DG18) and incubated at 25°C for 7 days. Result: The spore concentrations of xerophilic fungi were between 3.0x101 and 2.3x10³ cfu/m³ air and reached the maximum in the summer months. The total particle counts reached their maximum of 8.9x107 pa/m³ in winter. It was found that the fungal spore concentrations were high at a temperature of 30°C and a relative humidity (RH) of 70-80%. The spore concentrations of Cladosporium spp. in the air was in line with the fungal spore concentrations. The spore concentrations of Cladosporium spp. increased with rising air temperature but were independent of RH. The spore concentrations of Penicillium spp. and Aspergillus spp. increased with increasing concentrations of fine particles and reached a maximum at RH of 70%, whereas the air temperature did not show a significant impact. Conclusion: The background values of the fungal spore concentrations in the ambient air were rising during summer months and they did no correlate to the particle counts. The seasonal, meteorological and environmental factors play an important role in the release and distribution of particles and fungi in the air. Further studies are needed to explicate tangible background values of microorganisms at different environmental conditions. Moreover the concentration and identification of other fungal species could be investigated.

Abstract Number	**P-1-19-06**
Presenter	Rakhmanbek Toichuev*, Saparbai Zholdoshov
Exposure	microbial environment
Health domains	infectious diseases
Type of research	review

Characteristics of epizootic and epidemic processes of anthrax in southern Kyrgyzstan.

Objective: To study the regional peculiarities of anthrax manifestation, to create anthrax stationary unfavorable site cadastre. The work was performed under the ISTC Project KR-1516.Materials and methods: The present work was performed by the Institute of Medical Problems of National Academy of Sciences in conjunction with Osh Antiplague Station of the Republican Center for Quarantine and Extremely Dangerous Infections and Osh Inter-District Centre of Veterinary Diagnostics under the ISTC Project KR-1516. The data obtained from epizootic, clinical postmortem and microbiological examinations were used as materials. Statistical surveys, archival and current data (1936 – 2012) were analyzed.Results:Retrospective analysis showed that the number of anthrax outbreaks among the livestock decreased from 482 (1971-1980) to 36 (1981-1990). Since 1990, the number of outbreaks increased from 71 (1991 -2000) to 89 (2001-2012). Diverse climatic conditions of southern Kyrgyzstan affect the intensity of epizootic manifestation of anthrax. A total of 960 head of animals were registered in anthrax stationary unfavorable sites in 497 settlements during 1960 - 2012. Of them, 500 (52.1%) were small cattle, 339 (35.3%) cattle, 46 (4.8%) horses, 71 (7.3%) pigs, 2 (0.2%) donkeys, and 1 (0.1%) dog.Analysis of the incidence of anthrax among the livestock in southern regions showed that small cattle were more likely to be affected with anthrax in 2 out of 3 Provinces during 1960 to 1978. As of October 20, 2012, the overall number of anthrax foci registered in southern Kyrgyzstan was 671. Since 1980, cattle have been considered the main source of anthrax infection despite the reduction in the number of cattle.Conclusion: Thus, the analysis of the incidence of human and animal anthrax has shown that southern regions of the Republic seen qualitative changes in the nature of epidemic process. New correlation of the incidence of anthrax among human and animal populations was established.

Abstract Number	**P-1-19-07**
Presenter	Alok Kumar Patra*, Bijaya Kumar Padhi, Pravas Ranjan Misra, Pinaki Panigrahi
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

Characterization of indoor viable microorganisms in residential homes

Background: Inhalation of airborne microorganisms in indoor environments has been associated with the development of respiratory disorders. Aim: Assessment of culturable microorganisms (bacteria and fungi) in different residential indoor environments and to examine the role of temperature, humidity, and indoor air quality. Methods: The study was performed using single-stage viable cascade impactor (Biostage) and VersaTrap spore trap cassette with the help of QuickTake 30 sample pump. The sampling device was equipped with an electronic data logger (HOBO) to record temperature and relative humidity during the sample collection. Air was passed through different selective media for growth of bacteria and fungi. Numbers of colonies were counted and identified to the genus level was done by staining and biochemical tests. Sampling characteristics included housing condition, room occupancy, cooking procedure, and seasonal variation. Results: The average concentration of bacteria and fungi in indoor air was 840±320 CFU/m3 and 105±28 CFU/m3 respectively. The predominant bacterial species identified by culture techniques were Coliforms, Pseudomonas, Staphylococcus, Streptococcus, and Clostridium. Actinomycetes and Aspergillus were dominant fungal species in indoor air samples. We found a significant correlation between indoor microbial content in kitchens using biomass fuel compared to other rooms. Bacteria levels also exhibited a seasonal variation, usually higher in the summer. Ongoing studies are comparing incidence and types of health outcomes in the inhabitants in multiple sets of households with varying degree of humidity (some with molds on walls), that use biomass fuel vs. liquid petroleum gas, taking into consideration seasonal variations. Conclusions: Our study indicates that apart from typical health impacts due to various particles in indoor air, these environments can promote the survival and growth of microorganisms. When in synergy, these factors may have negative influence on respiratory health outcomes of the inhabitants.

Abstract Number	**P-1-19-08**
Presenter	Nikolia Anninou*, Aikaterini Chatzaki, Fotini Papachristou, Christos Nikolaidis, Michael Pitiakoudis, Constantinos Simopoulos
Exposure	microbial environment
Health domains	cancer
Type of research	exposure measurement

Co-exposure to Ochratoxin A and Sterigmatocystin: in vitro assessment of mycotoxin's effects on hepatocellular carcinoma.

Background: The increased international awareness on mycotoxin hazards indicates the possible negative impact on Public Health of certain mycotoxin combinations. However, minor attention is given on the effects resulting from chronic exposure to low amounts of mycotoxin mixtures. Aims: To examine apoptotic and cytogenetic effects of two common environmental contaminants that share hepatoxic and carcinogenic properties. These are Ochratoxin A (OTA) and Sterigmatocystin (STER) applied alone or in combination at sub-toxic concentrations on the human hepatocellular cancer cell line Hep3B. Methods: Caspase-3 activity was used as an apoptotic marker. MTT assay and mitotic index (MI) were used as cancer cell viability and cytotoxicity endpoints. The Sister Chromatid Exchange (SCEs) methodology was applied to assess possible genotoxic activity. Results: Single STER dosage reduced MI and MTT activity of Hep3B, exhibiting cell toxicity in concentrations 10-12 -10-6 M, while single STER and OTA administration enhanced caspase-3 activity. Co-administration of STER-OTA reversed the effects of single agents on MI, MTT and caspase-3 at concentrations <10-8 M. Finally, both mycotoxins, alone and in combination, significantly increased SCE ratio of Hep3B. Conclusions: Hep3B exposure to sub-toxic levels of STER exerted a significant apoptotic and cytogenetic potential. Co-treatment with OTA-STER reversed all but genotoxic actions. Apparently, in vitro exposure to these toxins alone or in combination indicates effects that require further evaluation in order to illuminate possible hazardous outcomes on Public Health.

Abstract Number	**P-1-19-09**
Presenter	Hsiao-Chien Huang, Chi-Yu Chuang, Shinhao Yang, Chin-Hsiang Luo*, Wei Fang, Po-Chen Hung
Exposure	microbial environment
Health domains	respiratory disease
Type of research	exposure measurement

Culturable airborne bioaerosol characteristics during greenhouses in Taiwan

Biological hazards exposure presented in the greenhouse is an important occupational health issue and has not been well characterized in Taiwan. This study aims atinvestigating the strains and concentrations distributions of bacterial and fungal bioaerosols within three targeted greenhousesat summer and autumn seasons. In additon, the effects of environmentalfactors including temperature, humidity and wind velocityon bioaerosols concentration distribution were evaluated. The results showed that main fungi aerosols species were Penicillium spp., Aspergillus spp., Acremonium spp., Trichoderma asperellum and yeasts. Nocardiopsis spp., Agromyces spp., Bacillus subtilis, Micrococcus spp., Staphylococcus spp. were the dominant bacterial aerosol species in the targeted greenhouses. Inthe Anoectochilus culture greenhouse,the indoor bacteria and fungi bioaerosol concentrations were 212-2,874 CFU/m3 and 565-9,258 CFU/m3. In the 1th Orchid planting greenhouse,the indoor bacteria and fungi bioaerosol concentrations were 118-1,674 CFU/m3 and 1,154-6,432 CFU/m3. The indoor bacteria and fungi bioaerosol concentrations in the 2ndOrchid planting greenhouse were 106-565 CFU/m3 and 1,107-7,939 CFU/m3.The analysis results indicated that the indoor fungi and bacteria bioaerosols were higher than outdoors ($p<0.05$); fungi and bacteria bioaerosol concentrations in different sampling sites within greenhouse did not preformed statistical significantly variations ($p>0.05$); nonsignificant seasonal differences were observed in all sampling data ($p>0.05$). According to the sampling data, relative humidity affected fungi concentration levels more than other environmental factor did, especially irritation and air humidifying inside the greenhouse. We recommend greenhouse horticulture workers in the higher relative humidity condition should equipped withrespiratory protectors to minimize the biological hazards exposure.

Abstract Number	**P-1-19-10**
Presenter	Soon-Bark Kwon*, Jaeyoun Jang, Jihan Song, Youngmin Cho, Wootae Jeong, Duck-Shin Park
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

Distribution profile of microorganisms found in patients, surface and air environments in a hospital

Hospital acquired infections tend to spread through several routes of transmission. Infectious particles expelled from patients can be the potential for the spread of disease and also airborne pathogens existed can enter the patient's body through the normal respiration process. Microorganisms that colonized on the surface can cause illness in patients through the direct and indirect contact. In this study, the relationship between microorganisms found in patients and environments in an intensive care unit (ICU) has been investigated. The study was conducted over the study period June 25, 2012 to August 28, 2012 in selected parts of an ICU inside of a university hospital located in Seoul, South Korea. Three trials of both surface and air sampling were made at selected sampling locations with four different sites such as bed rail, medical device, and computer mouse. Sample identification was performed by either MLPA (Multiplex ligation dependent probe amplification) or sequencing analyses. Patient data such as age, diagnosis, sites for a laboratory test, and identified bacteria were obtained to map the distribution of microorganisms in an ICU, considering possible links between surface contacts of the patients and airborne environment. From mapping the distribution of A. baumannii found in patients and environments, the prevention of hospital acquired infections is considered as a process including air, surface and patients' characteristics.

Abstract Number	**P-1-19-11**
Presenter	Sandra Walser, Doris Gerstner, Bernhard Brenner, Caroline Herr*
Exposure	microbial environment
Health domains	respiratory disease
Type of research	review

Environmental relevance of cooling towers - a systematic review of legionellosis outbreaks

Background Bioaerosols from cooling towers are often suspected to cause community-acquired legionellosis outbreaks. Uncertainty exists about the release and distribution of Legionella into the air, the occurrence of the respirable virulent form and the level of the infective dose. Aims We aimed to evaluate studies on Legionella outbreaks attributed to cooling towers. A systematic review, including data on morbidity and mortality, risk groups, diagnostic tools, meteorological conditions, maintenance actions, and comparative analysis of clinical and environmental isolates, was performed. Methods The literature search was conducted in Medline including publications from January 2001 to August 2012. Relevant findings were synthesized in form of a narrative summary. Results 19 outbreaks were identified affecting 12 countries. Recurring events were observed in Spain and Great Britain, 1609 confirmed cases of legionellosis and 102 cases of death (case-fatality rate 0-29%). Median time between onset of symptoms of first and last case was 36.5 days. The most frequent risk factors were smoking and underlying diseases in about half of the studies. The meteorological conditions varied strongly. Several studies reported a temporal association of outbreaks with technical interventions. A match of clinical and environmental isolates by serotyping and/or molecular subtyping was confirmed in 16 (84%) outbreaks. Conclusion Legionella-contaminated cooling towers as environmental trigger can cause severe health problems and even death of susceptible individuals. Consequently, public health authorities should enforce prevention and rapid risk assessment of outbreaks. Therefore, the registration of cooling towers is important to accelerate source identification and to shorten outbreak duration. To prevent and control Legionella contamination of cooling towers, maintenance actions should aim at low-emission procedures.

Abstract Number	**P-1-19-12**
Presenter	Naohide Shinohara*, Masahiro Tokumura, Kazuhiro Hashimoto, Makoto Sekine, Misae Kazama, Yuji Kawakami
Exposure	microbial environment
Health domains	no health domain
Type of research	exposure measurement

Fungal levels in houses in the inhabitation-limit area of the the Great East Japan Earthquake

On March 11, 2011, the Great East Japan Earthquake and the subsequent tsunami struck the northeastern coast of Japan and damaged the Fukushima Daiichi nuclear power plant. On March 14, 2011, a total of 77,000 residents were evacuated from ten towns and villages within 20 km of the power plant. Even now, some evacuees are restricted from returning to their housesin the evacuation area, and others are restricted from staying overnight in their houses in the inhabitation-limit area.The fungal levels at 5 places in 6 houses (A–F) were measured in the inhabitation-limit area in August 2012 and February 2013. Attached fungi were also sampled in these houses. The air exchange rates, temperature, and humidity were also measured. The occupants of a house A didn’t go home after the Earthquake.After the termination of the evacuation period for their town (April 2012),the occupants of house B, C, D, E went home once, once a month, once or twice a month, and once a week, respectively. The first floor of house F was damaged by the Tsunami. In summer, the fungal levels were extremely high (> 52,700 CFU/m3) in houses A and B, and the levels measured in houses C, D, E, and F were 7236, 3224, 1084, and 7460 CFU/m3, respectively. In the two houses, A and B, strains of Aspergillus ochraceus, which has nephrotoxic potential, were detected in addition to Cladosporium spp. and Penicillium spp. The indoor fungal levels were inversely related to the frequency of return of the occupants. The air exchange rates were 1.0, 1.4, 0.55, 0.18, 1.3, and 6.4 /h in these houses, respectively. Some houses were damaged by the Earthquake and have not been repaired. The indoor fungal levels were not related to the air exchange rates, temperature, and humidity.

Abstract Number	**P-1-19-13**
Presenter	Wei Che Chiu*, Yu-Tse Tsan, Shih-Li Tsai, Pau-Chung Chen
Exposure	microbial environment
Health domains	neurodegeneration
Type of research	cohort study

Hepatitis C Viral Infection Increases the Risk of Dementia

Background: Hepatitis C virus (HCV) infection produces a chronic systemic disease. In addition to its effects to liver, patients with chronic HCV infection may exhibit fatigue, depression, reductions in their quality of life and cognitive impairment. HCV infection may cause cognitive impairment, but no studies have focused specifically on cognitive impairment stemming from dementia. Aims: The purpose of this study was to investigate the potential increased risk for dementia in HCV-infected patients. Methods: We conducted a population-based cohort study based on the Taiwan National Health Insurance Research Database. From all potential participants aged fifty years or more, a total of 58,570 matched (1:1) pairs of HCV-infected patients and non-HCV-infected patients were included. Each subject was individually tracked from 1997 to 2009 to identify incident cases of dementia (onset in 1999 or later). Cox proportional hazard regressions were employed to calculate the hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between HCV infection and dementia in the HCV-infected cohort. Results: There were 3,291 cases of dementia reported in the HCV cohort during a follow-up period of 552,067.4 person-years with an incidence rate of 59.6 cases per 10,000 person-years (95% CI, 57.6-61.7). The multivariate-adjusted HR for dementia was 1.21 (95% CI, 1.15-1.27) for HCV-infected patients. Age subgroup HRs (95% CI) for dementia were 1.38 (1.23-1.55), 1.30 (1.20-1.39), 1.24 (0.14-1.36) and 1.51 (1.13-2.04) for participants in their fifties, sixties, seventies and eighties, respectively. There were 2,298 HCV-infected patients (4.0%) who completed antivirus therapy. The HR of treated patients was 0.98 (95% CI, 0.74-1.31) after adjusting for alcohol-related disease, liver cirrhosis and hepatic encephalopathy. Conclusions: HCV infection may increase the risk for dementia. HCV antiviral therapy may lower the risk of dementia in HCV-infected patients.

Abstract Number	**P-1-19-14**
Presenter	Jane Nkhebenyane*
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

Isolation of microbial bioaerosols and their antimicrobial profile from a South African hospital

Isolation of microbial bioaerosols and their antimicrobial resistance from a South African hospital ABSTRACT Health care-associated infections (HAI) caused by multidrug resistant organisms are an important patient safety concern. Although the environment serves as a reservoir for a variety of microorganisms, it is rarely implicated in the disease transmission except in the immunocompromised population.. Many respiratory pathogens are transmitted from patient to patient by the airborne route. Once these materials are brought indoors into a health care facility by air currents, patients and equipments, these microorganisms can proliferate into various indoor ecological niches and serve as a source for airborne health care associated infections. Moreover, antibiotic resistant pathogens constitute an important and growing threat to the public health. Studies have shown that more than 70% of the bacteria that cause hospital acquired infections are resistant to at least one of the drugs most commonly used to treat these infections. The aim of the study was to evaluate the bioaerosol level in the various wards of a tertiary South African hospital and to also characterize the microbial profile thereof. Materials and methods Sampling was conducted to provide a bioaerosol profile of the air within the designated hospital wards and to also characterise the antimicrobial profile thereof. The (SAS) Super-90 surface air sampler (PBI International, Milan, Italy) was used to collect bioaerosols. Kirby Bauer disk diffusion method was used to determine antibiotic resistance of the isolated strains to various antibiotics. Results and discussions The average recovered concentration of microbial bioaerosols was 1x 103 CFU/m3 and 1x 102 CFU/m3 respectively for Acinetobacter baumannii and Staphylococcus aureus. There was also multidrug resistance (≥ 3 antimicrobial agents) observed for A. baumannii . The results of this study indicate that the antibiotic resistant bioaerosols continue to pose a health threat to susceptible individuals in health care settings.

Abstract Number	**P-1-19-15**
Presenter	Gunilla Bok*, Linda Hägerhed Engman, Pernilla Johansson
Exposure	microbial environment
Health domains	healthrelated quality of life
Type of research	others

Occurrence of moisture damages and perceived indoor air quality in offices

Occurrence of moisture damages and perceived indoor air quality in offices Background Indoor air and mold investigations are often performed in buildings with reported complaints of indoor air quality (IAQ) or health problems among users. There is however a limited knowledge about the relationship between frequency of moisture damage and mold contaminations inside the building structure of ordinary offices without certain complaints. Methods A questionnaire with detailed questions concerning perceived IAQ and comfort were sent to 226 office employees, working in the same type of buildings. Among these, 25 rooms representing the whole spectra of reports of very good to very bad IAQ where chosen for technical inspection by experienced investigators. 44 inspections apertures were opened to get access to the inside of the external curtain wall. Data on type of ventilation, surfaces etc. were collected. In total 74 samples of building materials samples inside the wooden framed curtain wall were collected for microbiological analyses. Results The questionnaire study showed that a majority (70 %) rated their IAQ as good or very good while only 5 % reported a very bad or bad IAQ. Preliminary results show heavy microbiological growth inside the curtain wall of eight rooms. In three of these rooms the questionnaire indicated IAQ-related problems. In four rooms with a questionnaire-rate of “very good IAQ” mold damages were found in the construction. None or sparse mold growth were found in five rooms with bad or very bad IAQ. Conclusions Mold and moisture damages can exist in a construction without causing complaints about the indoor air quality. Also, complaints about the indoor air quality and musty odor might in some cases not directly be linked to moisture damages in the construction. Explanations for these preliminary findings are likely found in the building physical differences and individual differences among the employees responding to the inquiry.

Abstract Number	**P-1-19-16**
Presenter	Nai-Tzu Chen*, Mu-Jean Chen, Huey-Jen Su
Exposure	microbial environment
Health domains	infectious diseases
Type of research	case-crossover study

Precipitation affects reporting Legionnaires' disease in Taiwan

Background: Legionnaires’ disease (LD) is an acute pneumonia caused by legionellae, and rapid urbanization and changing precipitation have been considered plausible risk factors. Yet, only limited studies have investigated the relationships between precipitation and LD, especially those using long-term daily data. Aims: To evaluate the impacts of precipitation on the occurrence of sporadic LD in Taiwan. Methods: This study utilized a time-stratified 2:1 matched-period case-crossover design. We compared each case with self-controlled data using a conditional logistic regression analysis and estimated hazard ratios (HRs) for LD occurrence. The city, gender and age were defined as a stratum for each matched set to modify the effects. LD (1,188 cases) and meteorological (precipitation, temperature, and relative humidity (RH)) data were respectively acquired from Central Weather Bureau and Taiwan Centers for Disease Control in Taiwan from 1995-2011. Results: For lag day-0 to 14, the daily mean precipitations at lag day-0 and 11 significantly affect LD occurrence ($p < 0.05$). However, by further considering the latent period of 2-10 days for LD, the precipitation with 11-day lag is believed to have the real effect, which is associated with the rising risk of reporting LD incidence by 2.5% (95% CIs=0.3-4.7%) and 5.0% (95% CIs=0.6-9.6%), respectively, with every 5 and 10 mm increase of average precipitation. Moreover, a negative correlation between daily mean temperature at 11-day lag and LD occurrence is also found (HR=0.975, 95% CIs=0.953-0.996). No significant association between RH and LD occurrence is identified ($p > 0.05$). Conclusions: An increase of daily precipitation is more likely to trigger the reporting LD occurrence where the risk is found particularly significant at 11-day lag. However, in view of the increasing variation in precipitation distribution, the event of extreme precipitation may be considered in further analyses to acquire a more precise association.

Abstract Number	**P-1-19-17**
Presenter	Janie Shelton*, Peter Wallner, Georg Pommer, Dagmar Seidl, Dieter Werner, Hans-Peter Hutter
Exposure	microbial environment
Health domains	allergies
Type of research	cross-sectional study

Predictors of residential mold growth in Vienna, Austria

Background: Indoor exposure to mold presents a relevant public health risk in central Europe. Mold exposure can increase the risk of upper respiratory tract infections, cough, and can trigger asthma episodes among asthmatics. Here we evaluate predictors of residential mold growth in an urban environment in central Europe. Methods: An online questionnaire was developed by experts of the city of Vienna, Austria. In addition information about mold growth and growth prevention was given to the respondents. Data was collected on mold growth, location of the mold, housing size, age of the home, type of home, number of residents, behaviors of the residents, ventilation practices, humidity levels, and structural features of the home. Housing features and residential characteristics were evaluated as predictors of mold growth in multivariate logistic regression modeling. Results: The online questionnaire was answered by 4,689 residents of Vienna. The primary risk for mold growth was over-crowding (2 and more residents in a home smaller than 40m2 or 4 and more in a home less than 80m2) (OR=2.32). Protective features against mold were ventilating the dwelling with windows wide open vs. ventilation by tilted windows (OR=0.68), maintaining humidity less than 55%, and recently installed insulation (OR=0.69). Conclusions: Overall efforts should be made to reduce over-crowding and keep thermal insulation up to date. Improving ventilation behavior of the residents, especially in winter, may reduce mold growth.

Abstract Number	**P-1-19-18**
Presenter	Jesse Negherbon*, Félix Rivera-Mariani, Thomas Hartung, Patrick Breysse
Exposure	microbial environment
Health domains	respiratory disease
Type of research	exposure measurement

Quantification of the Total Proinflammatory Potential of Particulate Matter from Bioaerosol in a Broiler Poultry Facility

Background: Workers in poultry facilities are exposed to high concentrations of particulate matter (PM), which is principally generated by the re-suspension of dusts containing animal waste and feed materials. This PM has a complex composition, carrying a multiplicity of biogenic constituents that may include fungal matter, allergens, and microbial cell wall components (i.e.- endotoxin). Many of these constituents are known to induce adverse proinflammatory cascades in the human innate immune system and their inhalation may represent a respiratory health hazard. Customarily, the compositional analysis of agricultural bioaerosol has relied on assessing components individually, rather than capturing the proinflammatory potential of the full PM matrix. Aims: Our objective was to use a novel whole blood assay (WBA) to quantify the total proinflammatory potential of PM from the indoor air of an active broiler poultry facility, characterizing the difference in potential between the inhalable and respirable size fractions. Methods: PM was collected on PTFE filters using active aerosol samplers and PM mass on filters was determined gravimetrically. We used a WBA to measure the potential of the PM to elicit the release of the proinflammatory cytokine Interleukin (IL) -1β from a human whole blood system. Whole blood for the assay was drawn from five healthy individuals, pooled, and frozen with a cryoprotectant. Filter samples were directly incubated in aliquots of thawed blood, and IL-1β release was then determined via ELISA. Results: Analysis indicates the proinflammatory potential of respirable PM, per unit mass, is 10-fold higher than that of inhalable PM (17x106 vs. 1.6x106 pg IL-1β/mg-PM, respectively). Subsequent analysis will compare this poultry facility PM with ambient PM. Conclusions: This study demonstrates the utility of the WBA and suggests that the proinflammatory potential of this poultry facility PM is principally borne by respirable particles.

Abstract Number	**P-1-19-19**
Presenter	Ching-Wen Chang*, Nien-Tzu Hung, Chih-Yong Chen, Po-Chen Hung, Shih-Lin Lo
Exposure	microbial environment
Health domains	respiratory disease
Type of research	exposure measurement

Quantification of viable bacteria in air by molecular assays

Microbes in air has gained particular attention due to the adverse impact on human health. The studies on monitoring airborne microbes are usually based on the analysis with culture assay. However, airborne bacteria may be present as viable but not culturable state; therefore, the exposure level to airborne bacteria may be underestimated by culture assay. To deal with this issue, this study was initiated to develop a qPCR-based method coupled with nucleic acid dyes (ethidium monoazide, EMA, and propidium monoazide, PMA) that quantified total viable bacteria exclusively. Various types and concentrations of nucleic acid dyes were evaluated, and the range of the limit of detection was determined. Moreover, the developed method was validated in different environments. For live cells, our results showed no statistical significant difference in the DNA concentration between PMA-treated and -untreated samples. On the other hand, a significant decrease of DNA concentration was observed for the heated (dead) cells pretreated with PMA as compared to untreated ones. These results showed that the PMA penetrated dead bacteria and inhibited the DNA amplification in qPCR, indicating that PMA coupled with qPCR (PMA-qPCR) is applicable to quantify live bacteria exclusively. Moreover, the DNA concentrations measured in the group of heated cells were similar when pretreated with PMA of 1.5 ug/mL or greater. Thus, PMA at 1.5 ug/mL coupled with qPCR was considered as the most suitable for quantifying viable bacteria. As for testing on the limit of detection of the PMA-qPCR assay, a linear range (R2=0.993) was obtained for the cells between 1×105 and 1×108cfu/mL. The PMA-qPCR was further applied to analyze the air samples collected from hospital, poultry and swine housing, and the results showed that the concentrations of viable bacteria were always greater than those of culturable bacteria but lower than those of total bacteria. The present data demonstrate that the PMA-qPCR developed was suitable for quantification of viable bacteria in various environments.

Abstract Number	**P-1-19-20**
Presenter	Jennifer Goodnight*, Manmeet P Sandhu
Exposure	microbial environment
Health domains	diseases of the digestive system
Type of research	others

Social Handwashing Ladder: A practitioner's tool for initiating a handwashing intervention

Objective: A handwashing program is a cost-effective, life-saving public health intervention that can help decrease the incidence of various communicable diseases in developing nations. Unfortunately, handwashing interventions in impoverished communities are often hindered by the unilateral promotion of official handwashing guidelines, which are inappropriate for these communities since they assume soap, clean water and towels are readily available. Methods: Current handwashing recommendations and their applicability to hygiene interventions in developing nations are discussed. Results to Date: This paper presents a novel handwashing ladder which emphasizes that access to the physical resources of soap, water and towels should be addressed in hygiene interventions. Some examples of how to use this ladder to more sustainably move a population towards best known handwashing practices are also presented. Conclusions: This handwashing ladder allows for more sustainable progress in hygiene within a community than previous guidelines, since progress can be made incrementally, and, in many cases, on one individual aspect of the handwashing process at a time.

Abstract Number	**P-1-19-21**
Presenter	MARCOS XAVIER Silva*, Mariana Brito Gontijo, Rafael ROMERO NICOLINO, Soraia DE ARAÚJO DINIZ, Frederico FIGUEOREDO AMANCIO, Marcela LENCINE FERRAZ
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

Spatial and temporal distribution of hantavirus cardiopulmonary syndrome (SCPH) and the association with the major land uses in Minas Gerais, Brazil, from 1998

The hantaviruses are antropozoonoses cosmopolitan considered emerging diseases whose etiological agents are viruses of the family Bunyaviridae, genus Hantavirus. Disease transmission to humans is associated with wild and rural environments in which the rodent subfamily Sigmondontinae, SCPH reservoirs are present. In the state of Minas Gerais, in the Cerrado region of the rodent Necromys lasiurus has the highest prevalence of hantavirus infection and is associated with Araraquara virus. Changes in natural vegetation, where the man introduces plants of commercial interest are a new power supply to wild rodents, leading to the rapid increase of population in areas occupied by humans, which favors the epidemics. A retrospective observational study on the SCPH the period 1998 to 2007 and the major land uses in 1995-96 and 2006 was woked. Spatial analysis of the cases was performed by identifying clusters of local probable cases of infection related to SCPH in 1998 and 2007. For the perception of the factors studied, and variables SCPH major land uses in historical periods, 1995-96 and 2006, we analyzed the set of these two universes by the method of principal components analysis (PCA). The temporal distribution of cases of SCPH it was noted that these occurred throughout the year, however, with a higher concentration between the months March to August, with 76.5% (148 cases). The geospatial analysis showed that the were identified regions of the state with clusters of human cases of SCPH in Cerrado. The Principal Component Analysis indicates that the greatest association between cases and variables SCPH acreage of pasture and planted area of natural forests. The crops of corn, rice, beans and canesugar have limited influence in association with the cases. The inertia of the Principal Components Analysis was relevant to 79%. The Cerrado in Minas Gerais has a higher risk area for the appearance of cases of SCPH during the study period.

Abstract Number	**P-1-19-22**
Presenter	Ikeda Koichi*, Shoichi Nakai, Kazuya Tamura, Lin-Lin Huang
Exposure	microbial environment
Health domains	healthrelated quality of life
Type of research	exposure measurement

Study on Microbial Contamination-Control Measures of Evaporative Humidifier for

The problem of the microbial contamination in air-conditioning systems is mainly because of bacteria and fungi, and spread of the microorganism indoor environments is of great social concern. Heating type humidifiers are, therefore, used normally in the indoor environments, especially in hospitals since the heating type humidifier is very much capable of sterilizing the infectious agents in humidifying water. However evaporative type humidifiers are getting popular to be used in the air-conditioning systems, even for the medical facilities, taking energy efficiency into considerations since the heating type humidifier is not energy efficient. But microbial contamination is considered carefully because the humidifying elements are always wet and are very likely to fertilize the infectious germs. We made laboratory experiments to examine the counter measures for microorganism pollution using sodium hypochlorite and electrolyzed water. Sterilization performance of these chemicals and odor intensity of the humidified air are investigated. The results showed that the best sterilization was shown in the case of strong electrolyzed water. However practically enough results were also obtained from experiments on the weak electrolyzed water. There were no case where musty smell was felt by any testee. We reached conclusion that dosage electrolyzed water into the humidifying water is effective to prevent biological contamination in the evaporative type humidifier so far as the present tests. But more research is needed because practical fields are more complicated than the experimental settings and, are more likely to be polluted by un expected pollution agents.

Abstract Number	**P-1-19-23**
Presenter	Rakhmanbek Toichuev*
Exposure	microbial environment
Health domains	infectious diseases
Type of research	case-control study

The effect of the reduction in the levels of Bifidobacteria in human gastrointestinal tract on the incidence of brucellosis.

Objective: to study the correlation of bifidobacterial counts in gastrointestinal tract and the incidence of brucellosis.Materials and methods: A total of 48 families whoselivestock turned out to be infected with Brucella spp. were subjected to analysis. Of them, 57 individuals (Group I) contracted brucellosis.Group II (control) comprised of 119 healthy members of the same families. Bifidobacterial counts in gastrointestinal tract were determined by using conventional procedures.Results: Out of the total of 48 families under examination 57 patients with brucellosis were reported. In one family 4 out of the total of 7 members contracted brucellosis, in other - 3 out of 6 members, and 2 members contacted brucellosis in 4 cases. One member in each family was reported to contract brucellosis in the rest of 42 families. Stool specimens isolated from 176 individuals were analyzed for Bifidobacteria. In Group I, 55 (96.5%) patients showed decreased bifidobacterial level 103.4 ± 0.8,P>0.01. One patient showed bifidobacterial level 107.More pathogenic forms of Brucella spp. were likely to get through the gastrointestinal tract or through the skin.In Group II, decreased bifidobacterial levels (105-6) were reported in 16 out of the total of 119 under examination. The rest of the observed people showed the level of Bifidobacteria within a normal range. Conclusion: Thus, decreased bifidobacterial level is likely to be one of the main causes of brucellosis in human population, but this assumption requires further investigation.

Abstract Number	**P-1-19-24**
Presenter	Judith Lupatsch*, Claudia E. Kuehni, Ben D Spycher
Exposure	microbial environment
Health domains	cancer
Type of research	cohort study

The Role of Population Mixing in the Aetiology of Childhood Leukaemia: A Swiss National Cohort Study

Background:Leukaemia is the most important cancer in childhood but little is known about its causes. It has been suggested that early infections might play a role: Kinlen (1988) proposed that childhood leukaemia might be a rare response to a common, yet unidentified, infection. Rapid population influxes into isolated areas (population mixing) could lead to epidemics of the infection in question and a localised increase in incidence of leukaemia. Previous studies investigating the population mixing hypothesis showed heterogeneous results. Aims: The aim of this study is to examine the association between incidence of childhood leukemia and measures of population mixing in a nation-wide cohort study. Methods: We will include Swiss residence aged <20 years during the period 1985-2012. Leukaemia cases will be obtained from the Swiss Childhood Cancer Registry (SCCR) and person time at risk from the Swiss National Cohort (SNC). Outcomes will be any leukaemia, acute lymphocytic leukaemia (ALL), and important cytogenetic subtypes of ALL. We will calculate the following measures of population mixing at community level: (1) Proportion of the population that was not living in the same community 5 years earlier (5-year in-migration)(2) Diversity (Shannon Index) of places of origin of 5-year in-migrants; (3) Change in annual in-migration relative to average in-migration in previous years. We will use Poisson regression to calculate associations between leukaemia incidence and measures of population mixing for communities of residence at diagnosis and also at birth. Significance: Compared to previous studies, this study will measure population mixing with greater spatial and temporal resolution, both at birth and at diagnosis. It should therefore provide new insights into the potential association of childhood leukaemia and population mixing. Understanding the role of infections in the aetiology of childhood leukaemia could open possibilities for prevention.

Abstract Number	**P-1-19-25**
Presenter	Siming You*, Man Pun Wan
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure modeling

The role of resuspension in infection transmission

Deposited pathogens or pathogen-laden particles could be resuspended due to aerodynamic or mechanical disturbances, and leads to the risk of secondary infection once being airborne again. However, the role played by resuspension of pathogen-laden particles in infection transmission has not yet been well-understood. The existing risk assessment models rarely take particle resuspension into consideration in an explicit manna. In this work, a risk-assessment model capable of incorporating the effect of pathogen resuspension was proposed to assess the infection probability of B. anthracis spores indoors. The proposed risk-assessment model is based on the dose-response model and indoor particle dynamics where the pathogen-laden particle resuspension was incorporated into the mass balance model. Two resuspension scenarios, including the pathogen resuspension from ventilation duct due to air flow and from the floor of living room due to human walking were analyzed. The particle resuspension rates from ventilation duct and floor were predicted using our previously proposed particle resuspension models. The model of particle resuspension from ventilation duct is based on turbulent bursts and adhesion force distribution, while the model of resuspension from floor is based on the theoretical solution of mass balance model. In order to validate the proposed risk assessment model, the attempt to predict literature cases using the model was made. Further analysis about the comparison between the case with pathogen resuspension and that without pathogen resuspension shows that the infection probability for the residents could be enhanced by 30% and 10% due to the pathogen resuspension from the floor and ventilation duct, respectively. The result of model suggests that the pathogen resuspension whenever possible should be considered during the control and management of infection transmission.

Abstract Number	**P-1-19-26**
Presenter	Chi-Chi Lin, Hsu Kunnan*
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	case-control study

The study of nano metal to enhance mold resistance ability of indoor building materials

Extreme weather nowadays causes droughts and floods in many countries. The flood brings mold problems and deteriorates indoor air quality. It is difficult to remove mold on building materials. This study is aimed for improving mold resistance ability of selected building materials. Eight kinds of building materials were used for experiments. They are wooden flooring (WF), wooden flooring of green building material (GWF), calcium silicate board (CSB), calcium silicate board of green building material (GCSB), gypsum board (GB), gypsum board of green building material (GGB), mineral fiber ceiling (MFC), and mineral fiber ceiling of green building material (GMFC). Each building material was cut into 5 × 5 cm specimen, with Aspergillus, Penicillium fungi implanted. The humidity was controlled at 85%. Single kind or different combination of nano metal Ag, Cu, Zn and TiO2 was added in each specimen and cultured for 35 days to investigate enhancement of the ability for nano metals to resist mold. The results show the higher the concentration of nano metal, the stronger the anti-mold effect is. Besides, distinct building materials have different anti-mold properties. After TiO2 being impregnated at a concentration of 40 g/L, WF, MFC and GWF have better resistance to Aspergillus fungi, WF and GB have better resistance to Penicillium fungi. After nano silver being impregnated at a concentration of 0.03 g/L, MFC, GB, GMFC, and GGB have better resistance to Aspergillus fungi, WF, CSB, GMFC, GCSB have better resistance to Penicillium fungi. After nano copper being impregnated at a concentration of 0.05 to 0.10 g/L, WF has better resistance to Aspergillus fungi, WF, GB, GMFC, and GGB have better resistance to Penicillium fungi. After nano-zinc being impregnated at a concentration of 0.30 g/L, GGB has better resistance to Aspergillus fungi, WF and MFC have better resistance to Penicillium fungi. With appropriate nano metals being added, the anti-mold ability of building materials was found to be effectively improved and therefore improve indoor air quality.

Abstract Number	**P-1-22-01**
Presenter	Win-Jet Luo*, You-Lei Wu
Exposure	organic compounds
Health domains	respiratory disease
Type of research	exposure measurement

Analysis of Toluene Concentration Degradation Utilizing Photocatalysis of TiO2 combined with Ozone

This study used experimental measurements and numerical simulations to explore the use of ozone accompanied with TiO2 to improve the degradation rate of the harmful gas toluene. Different circulating air flow rates (0.1m3/s, 0.12m3/s, and 0.15m3/s) and initial toluene concentrations (40ppm, 80ppm) were used as parameters to explore the indoor toluene concentration degradation effect of the photo-catalysis of TiO2 accompanied with ozone (O3) under the irradiation of ultraviolet light bulbs. According to the research findings, when the circulating air flow ratewas greater (0.15m3/s), whether the toluene initial concentration was 40 ppm or 80 ppm, as well as with or without ozone, the use of TiO2 could reduce the toluene concentration to below 10ppm within 40 minutes. With the greater flow rate, the concentration degradation efficiency also can be enhanced under different flow rates tested. The experimental results showed that regardless of the operational conditions, the degradation effect of UV/TiO2/O3 on the indoor toluene concentration was superior to that of the method using UV/TiO2. It was also found that for medium and low circulating air flow rates (0.1 m3/s and 0.12 m3/s,), it was very efficient to use ozone to enhance the TiO2 degradation of VOCs.Moreover, in the case of a circulating air flow rate of 0.12 m3/s, the UV/TiO2/O3 degradation effect was better. Based on the experimental results, this study established a theoretical analysis model for the application of UV/TiO2/O3 in reducing the indoor concentration of toluene and conducted numerical simulations according to the proposed model, with very good simulation results. The proposed theoretical model could be used as a useful tool for the early design of air-conditioning systems to purify indoor air quality.

Abstract Number	**P-1-22-02**
Presenter	Hua Qian, Rosemary Zaleski*, Chris Money
Exposure	organic compounds
Health domains	other
Type of research	exposure modeling

Approach for developing Specific Consumer Exposure Determinants (SCEDs) for Fuel and Lubricant Scenarios

The ECETOC TRA tool, a preferred lower tier exposure tool under REACH, provides conservative (intentionally high) estimates of consumer exposure. Under REACH, if a predicted exposure exceeds a substance hazard benchmark (Derived No Effect Level or DNEL) using lower tier tools, the assessment is either refined via higher tier analysis or Risk Management Measures are implemented to reduce the exposure predictions to values < DNEL. Much effort has recently been directed to identifying a rigorous and transparent approach for refining the TRA defaults so that initial exposure estimates are closer to reality, limiting the need to perform higher tier analysis. In 2012, ECETOC introduced the concept of Specific Consumer Exposure Determinants (SCEDs), a template that helps provide a basis for delivering a more realistic estimate of consumer exposure. We populated this template and developed 9 SCEDs to cover a range of consumer fuel use scenarios and 4 SCEDs to better define consumer lubricant use scenarios based on public data. SCED development required: data mining, data assessment, data documentation, and evaluation of the final scenario as whole. We describe the steps taken in SCED development, and provide examples of a completed product. This approach has general utility for documentation of consumer exposure determinants and development of improved consumer exposure scenarios. It is currently being implemented by other industry sectors as well.

Abstract Number	**P-1-22-03**
Presenter	Toshio Kawai*, Tsuboi Tazuru, Atsuko Araki, Ait Bamai Yu, Tajima Shuji, Shi Cong, Kishi Reiko
Exposure	household air pollution
Health domains	allergies
Type of research	others

Biological monitoring of environments exposure to DEHP by urine?analysis for?2-Ethyl-1-hexanol

Background: In environment, 2-Ethyl-1-hexanol (2EH) is known to be emitted by the hydrolysis of DEHP and health effects of its exposure have been concerned. It is also released along with the metabolism of DEHP to MEHP. There is no report regarding biological monitoring of 2EH in urine. Therefore, the aims of the study are I. to establish a method to measure 2EH in urine, II. to validate the availability of 2EH as a biological monitoring by DEHP administered mice urine, and III. to determine the levels of 2EH among elementary school children and their mothers. Methods: Sample preparation consists of 1. deconjucation with an enzyme, 2. extraction with ethyl acetate, and 3. GS/MS analysis .Column was DB-5MS column .Injection temperature was 290℃. Results: I. Retention time of 2EH were 7.74 min. Quantization ion and reference ion were 57 and 83, respectively. When spiked 1.0 and 10.0μg/mL 2EH to urine, desorption recovery rates were 102% and 86%, respectively. Good linear correlations were obtained from 0.01 to 10μg/mL (r=0.999), and LOQ was 0.02μg/mL. When MEHP was injected to GC at 290℃, MEHP was hydrolyzed to phthalic anhydride and 2EH. II. Urine samples of mice administered DEHP were analyzed, and the concentrations of MEHP and 2EH showed good linear correlation with the slope of 1.94 (r=0.931). Detected 2EH concentration should include both MEHP metabolites, and hydrolysis of MEHP side chane as a result of GC injection. III. Concentrations of 2EH of 62 elementally school children aged between 6-14 years old, and their 53 mothers were 0.086 and 0.067 mg/g. Cr, respectively . Conclusion: The established method of the determination of 2EH as a marker of DEHP exposure could be a useful and environmental friendly method with ethyl acetate. We found the levels of 2EH in human urine. This study was supported by Environment Research and Technology Development Fund (C-1151) of the Ministry of the Environment, Japan.

Abstract Number	**P-1-22-04**
Presenter	Tracey Woodruff, Carrie Dickenson, Janet Pan*, Roy Gerona, Joel D. Schwartz, Saunak Sen, Victor Fujimoto, Patricia Hunt
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	exposure measurement

BPA and BPA metabolites in umbilical cord serum during mid-gestation in a northern California cohort

Background: Bisphenol A (BPA) is a chemical widely used in numerous consumer products, resulting in nearly universal exposure among the U.S. population. BPA is an endocrine modulator and prenatal exposure is associated with numerous reproductive and developmental effects in animals. However, little is known about human fetal exposure or the ability of the fetus to metabolize BPA during mid-gestation. Objective: To measure fetal exposure to BPA and its metabolites during the 2nd trimester of pregnancy. Methods: We used targeted liquid chromatography-tandem mass spectrometry (LC/MS-MS) to measure unconjugated BPA and the two predominant BPA metabolic conjugates-BPA glucuronide and BPA sulfate- in fetal umbilical cord serum and maternal urine collected from voluntary 2nd trimester pregnancy terminations. Results: We detected unconjugated BPA (GM 0.16 ng/ml; range <LOD-52.26 ng/ml), BPA glucuronide (0.14 ng/mL; range <LOD-5.41 ng/mL) and BPA sulfate (GM 0.32 ng/mL; range <LOD-12.65 ng/mL) in all 85 cord serum samples examined. The conjugated to unconjugated ratio ranged from < 0.01 to greater than 300. Conjugated levels exceeded unconjugated levels in about three-quarters of the samples, but unconjugated levels were higher in samples with total BPA above the GM. In a subset of 29 matched maternal urine samples we found positive correlations between BPA conjugates in urine and cord blood (Spearman rho correlation 0.38 and 0.34 for BPA sulfate and BPA glucuronide respectively (p-value 0.07 and 0.04)). Total BPA levels were not correlated. Conclusion: We found universal fetal exposure to BPA with the novel finding of detectable BPA sulfate during mid-gestation among our study cohort. A small subset of fetuses had unconjugated BPA levels that exceeded what was measured in paired maternal urine samples.

Abstract Number	**P-1-22-05**
Presenter	Marika Berglund*, Sylwia Król, Anders Glynn, Tatiana Cantillana, Per-Ola Darnerud, Charlotte Bergkvist, Helen Håkansson
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Characterizing children's exposure to polybrominated diphenyl ethers (PBDEs) in diet, dust, and air

Background. Polybrominated diphenyl ethers (PBDEs) are present in breast milk, food, dust and air. This study presents a characterization of the total exposure to PBDEs via diet, house dust, and air, in children at different ages. Aim. To evaluate the exposure to BDE-47, -99, -100, -153 and -209 in children via different food commodities, dust ingestion, and air inhalation. Methods. The dietary exposure to PBDEs among Swedish children (4, 8-9 and 11-12 years old; n=2297) was estimated by combining concentration data from 2010 in six food commodities (dairy products, eggs, meat, fish, edible fats, and other fat-containing products) with the individual consumption data obtained from a 2003 survey using food diaries and questionnaires. Exposure via air and dust was modeled, taking into account age specific time-weighted dust ingestion and inhalation rates. Results. The highest mean dietary exposure to sum of five PBDE congeners was reported for 4 years old children (boys: 0.45 pg/kg bw/day; girls: 0.41 pg/kg bw/day) and the lowest for children 11-12 years of age (boys: 0.22 pg/kg bw/day; girls: 0.21 pg/kg bw/day). Fish (51%) and meat (27%) contributed the most of all food groups. The most abundant congeners were BDE-47 (fish) and BDE-209 (egg, meat, fat). House dust contributed most (87%) to the total exposure (most abundant congeners were BDE-209 and -99), with less contribution from diet (7%) and air inhalation (6%). Conclusions. For effective risk assessment and management, this study shows that it is essential to characterize children's exposure, and to perform age specific total exposure assessments. The results showed the importance of both defining a set of BDEs to include in the assessment as well as take into account and follow changes in environmental PBDE concentrations over time. Acknowledgment/Financial support: The Swedish Institute Scholarship (S Król)

Abstract Number	**P-1-22-06**
Presenter	Monica Lind*, Johanna Penell, Tord Naessen, Jonas Bergquist, Mark M. Kushnir, Lars Lind
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	cross-sectional study

CIRCULATING LEVELS OF PHTHALATES AND SEX HORMONES IN A POPULATION-BASED SAMPLE

Background: Phthalates are high-volume chemicals used in the production of plastics and various other compounds. Although they are traditionally regarded as PPAR-receptor agonists, effects on reproductive organs have been reported. Aims: To evaluate the relationships between circulating levels of four phthalate metabolites and sex hormones in humans. Methods: Plasma samples from 1000 70-year-old subjects were analyzed as part of a large population-based study (Prospective Investigation of the Vasculature in Uppsala Seniors). Eleven sex steroids and four phthalate metabolites were quantified, using liquid chromatography-tandem mass spectrometry (LC-MS/MS). Women with current/previous menopausal hormone therapy were excluded from evaluation. Results: Concentration of MEP, MiBP and MMP were positively associated with concentrations of estrone (E1) and estradiol (E2) in men (all $p<0.005$), concentration of MEP was positively associated with DEHA and pregnenolone, while concentrations of MiBP and MMP were negatively associated with concentrations of DEHA and pregnenolone. MEHP on the other hand was associated with the E2/testosterone ratio and concentrations of SHBG in women only (all $p<0.005$). Conclusions: Our data suggest that concentrations of circulating phthalate metabolites are associated with concentrations of sex hormones in samples of elderly subjects. Physiological effects of different phthalates are likely different and should be studied.

Abstract Number	**P-1-22-07**
Presenter	Amrit Kaur Sakhi*, Inger Therese Laugsand Lillegaard, Stefan Voorspoels, Elin Bjørge Løken, Anne Lise Brantsæter, Margaretha Haugen, Helle Margrete Meltzer, Georg Becher, Cathrine Thomsen
Exposure	food
Health domains	no health domain
Type of research	exposure measurement

Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated exposure in Norwegian adults

Background: Phthalates and bisphenol A (BPA) are industrial chemicals used in a wide variety of consumer products and have been associated with several toxic outcomes. Food is one of the major sources of human exposure to phthalates and BPA. Contamination of food can occur during food processing and through migration from packaging materials. In order to provide data for human exposure assessment, it is important to monitor the occurrence of phthalates and BPA in food items. Aim: The aim of the present study was to determine for the first time concentrations of phthalates and BPA in common Norwegian foods and beverages and estimate dietary exposure to these chemicals in the Norwegian adult population. Methods: Thirty seven different food items were included in the study. For most of the food items, the three most sold brands were purchased. BPA and ten different phthalates were analysed in these food items by VITO NV, Belgium. Results: BPA and five phthalates occurred above the limits of quantification in more than 50 % of the food items.The concentrations of BPA and most of the phthalates in Norwegian foods and beverages were found in the same range as in other European countries. Although the use of di(2-ethylhexyl) phthalate (DEHP) has been restricted in recent years due to its toxic properties, it still had the highest concentration among the 10 phthalates determined, followed by its replacement di-iso-nonyl phthalate (DiNP). We present her for the first time comprehensive data on the occurrence of DEHP replacements DiNP and di-isodecyl phthalate (DiDP) in food in Europe. The highest levels of phthalates and bisfenol A were found in canned meals and food items containing >10 % fat. We are presently combining the contaminant concentrations in food with intake data from the Norwegian national dietary survey Norkost 3 (2010-2011) to estimate the exposure from food.

Abstract Number	**P-1-22-08**
Presenter	Huan Shu*, Bo A.G. Jönsson, Malin Larsson, Eewa Nånberg, Åke Svensson, Carl-Gustaf Bornehag
Exposure	biomarker
Health domains	respiratory disease
Type of research	cohort study

Description of 1st trimester urinary levels of phthalate and phenol metabolites in 2,356 Swedish women in the SELMA study

BACKGROUND: Epidemiological studies have found the general population has been exposed to endocrine disrupting chemicals (EDCs) such as phthalates and phenols on a regular basis. Exposures to the developing fetus during critical points in the development are a concern. In the SELMA study we investigate the importance of pre and post natal exposure for EDCs and life style factors for development of chronic diseases in offspring such as asthma and allergy, reproductive related effects, neurodevelopmental disorders and metabolic effects including overweigh and obesity among small children in Sweden. OBJECTIVES: To evaluate the extent of exposure to phthalates and phenols in the urine of 2,356 SELMA pregnant women. METHODS: One spot urine sample was taken during the 1st trimester (wk 10) from 2,356 pregnant (mean age=30), the first visit at the midwifery clinic in Sweden. The samples were analyzed for 10 phthalate metabolites from six different phthalates, bisphenol A and triclosan. Urine was added with isotopically labeled internal standards, digested by glucoronidase and then analyzed by liquid chromatography tandem mass spectrometry without any further purification. The limits of detection (LODs) were between 0.01 and 0.1ng/ml and the coefficients of variation of the quality control samples generally better than 10%. RESULTS: All samples were above the LOD. The geometric mean and range of urinary concentration (ng/ml) was: MEP (68.39; [1.30-4419.35]), MBP (69.42; [3.03-2718.94]), MBzP (16.85; [0.25-3544.51]), MEHP (3.85; [0.14-213.09]), 5-oh (16.59; [0.24-1012.98]), 5-oxo (11.26; [0.05-611.77]), 5-cx (16.07; [0.73-757.17]), 7-oh (6.42; [0.06-1726.48]), 7-oxo (GM=2.98; [0.05-635.49]), 7-cx (10.03; [0.33-1661.24]), BPA (1.54; [0.05-111.26]), and Triclosan (1.25; [0.00-3356.79]). CONCLUSIONS: Exposure of phthalates and phenols are prevalent in Swedish pregnant women (highly susceptible population). Sources of exposure, uptake routes and health effects in children that associated with prenatal exposures will be investigated in the SELMA study.

Abstract Number	**P-1-22-09**
Presenter	Katia I Sokoloff*, Maryse F Bouchard, William D Fraser
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

Environmental phthalates exposure during pregnancy

Background. A large scientific litterature exists reporting facts and hypothesis about relation between some infant morbidity or dysfunctions, and perinatal exposure to external stress factors including chemical contaminants. Among these, phtalates are known for their endocrine disruption effects while hormone levels are essentials to maintain pregnancy and ensure fetus development. Their wide use in consumer products explain their environmental and human matrix ubiquity. Aims. Verify phthalates exposure levels in pregnant women and identify their sources. Methods. Data are provided by MIREC study (Maternal Infant Research on Environmental Chemicals 2008-2012) where 2000 pregnant women were followed in 10 canadian centres. Eleven urinary metabolites (MBP, MBzP, MCHP, MCPP, MOP, MEHHP, MEHP, MEOHP, MEP, MMP, MNP) from eight phtalates (BNP, BBzP, DCHP, DOP, DEHP, DEP, DMP, DNIP) have been measured during first pregnancy trimester. Results. Detection limit (LOD) varies among phtalates (0,2 à 0,7 µg/L). Samples proportions > LOD are : 100% for MBP, MEOHP and MEP, 99% for MBzP and MEHHP, 98% for MEHP, and 85% for MCPP. Highest median urinary concentrations, magnitude from 30 to 1 µg/L, are from DEHP, DEP, DBzP, and DOP : MEP, MBP, MEHHP, MEOHP, MBzP, MEHP, and MCPP. The one from MMP, MCHP, MNP and MOP were not determined because less than 15% of samples were > LOD. A priori identified sources in litterature for DEHP, DEP, DBzP, and DOP are : fragrances, PVC flexible products, deodorants, hair prays and moss and gel, shampoo, soap, nail polish, body lotions, printer ink, and insecticides. Conclusions. Phthalates level measured in canadian pregnant women are generally lower than reported in north america. Knowledge of sources and exposure levels associated with adverse effects will allow to lower pregnancy exposure with appropriate regulation considering fetus health. Identifying high exposure risk groups will be usefull for targeted intervention to ensure infant health.

Abstract Number	**P-1-22-10**
Presenter	Bo Strandberg, Gerd Sallsten, Kerstin Bergemalm-Rynell*, Lisa Svedbom, Marie Lewné, Aneta Wierzbicka
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	exposure measurement

Evaluation of polyurethane passive samplers as a tool for occupational PAH measurements

Background Exposure to PAHs at workplaces may give an increased risk of cancer. To simplify routine monitoring, passive air samplers (PAS) may be the only option since they are less disturbing than active sampling. Polyurethane foam (PUF) as a PAS in outdoor ambient air is well accepted and its capacity has been quite well studied. The applicability and capacity of the PUF need, however, to be further validated and tested under both laboratory and field conditions for typical occupational scenarios (i.e. 8 h sampling time) including particle associated PAHs such as benzo(a)pyrene-B(a)P. Aims Test and evaluate the PUF sampler; determine uptake rates in exposure chamber experiments and examine the validity of those uptake rates in an occupational situation when the sampler is worn by the workers. Methods Uptake rates were determined in two exposure chamber experiments, one with wood smoke and the other with diesel exhaust with 200-300 µg/m3 PM2.5. Following laboratory studies, the PUF were tested in the field as personal and stationary samplers for a working day (8h) in restaurant kitchens. Active sampling (Teflon filters for particle phase and XAD (II) or Perkin Elmer tubes (TenaxTA) for gas phase components) provided independent controls for each sampling period in all experiments. PAHs were determined by GC/MS methods. Results The concentrations in the exposure chamber experiments ranged for instance for phenanthrene from 10 to 450 ng/m3 and for B(a)P from 0.5 to 20 ng/m3. The uptake rates after 3-8 h sampling time for the 3-4 ringed PAHs were between 1.5 and 4 m3/day and for 5-6 ringed PAHs 0.2-0.8 m3/day. There were acceptable agreement between the PUF sampler (using the uptake rates obtained in the chamber lab experiments) and the active method in the field study. Conclusions The PUF sampler has a good potential to be used as stationary or personal sampler to monitor the exposure to PAHs.

Abstract Number	**P-1-22-11**
Presenter	Gerhard Heinemeyer*, Astrid Heiland, André Conrad, Regine Nagorka1 Nagorka, Stefanie Klenow
Exposure	organic compounds
Health domains	other
Type of research	exposure modeling

Exposure of DEHP and DINP via house dust

We evaluated the total exposure of toddlers to Di(2-ethylhexyl) phthalate (DEHP) and Di-isononyl phthalate (DINP). In addition to food, house dust represents an important exposure path particularly in this age. Original data from the German Environmental Survey for Children (GerES IV) have been used to estimate the exposure to DINP and DEHP via house dust. Deterministic and probabilistic estimations of intake of DEHP and DINP are based on 600 representatively collected house dust samples from GerES IV (Gefahrstoffe - Reinhaltung der Luft 70, 2010). For probabilistic estimations, the concentrations of DEHP and DINP were fitted to lognormal distributions using the @RISK best fit tool. Deterministic house dust intake defaults, namely 16 mg/d (average) and 110 mg/d (conservative), were taken from the 1995 German Exposure Factors Handbook (AUH report). Respective triangular and cumulative distributions were formed from the available AUH data for probabilistic estimation. On average, children are estimated to be exposed via house dust to 1.4 and 0.4 µg/kg bw/d of DEHP and DINP, respectively. Conservative estimates are 6.8 µg/kg bw/d for DEHP and 1.7 µg/kg bw/d for DINP. Probabilistic estimates confirmed these results. It can be concluded that house dust represents a relevant pathway of exposure, especially in small children. However, our results represent a basic estimate since the house dust intake rates are highly uncertain as they are extrapolated from soil intake. Therefore, a project aiming to improve the currently available reference values for house dust intake rates has been initiated within the framework of the German Environmental Research Plan 2012. Funding by the Federal Minister for the Environment, Nature Conservation and Nuclear Safety is gratefully acknowledged.

Abstract Number	**P-1-22-12**
Presenter	Judith Spungen, Tamar Berman, Rebecca Goldsmith, Thomas Goen, Lena Novack, Hagai Levine, Yona Amitai, Tamar Shohat, Itamar Grotto, Isabelle Karikakis*
Exposure	organic compounds
Health domains	no health domain
Type of research	cross-sectional study

Exposure to Bisphenol A and Organophosphates in the Israeli Population: Sources and Risk Factors

Background: The Ministry of Health Biomonitoring Study measured internal exposure to bisphenol A (BPA), organophosphate pesticides (OPs), and other contaminants. However, little is known about sources of exposure to these substances in the Israeli population. Methods: From December 2010 – January 2011, 250 individuals ages 20 – 73 were recruited from five regions in Israel. Urine samples and questionnaire data, including 24 hr dietary recall data, were obtained. Food mixtures reported were disaggregated to allow estimation of commodity intakes. Regression analyses were performed to identify risk factors for BPA and OP exposures. Results: Median creatinine adjusted urinary BPA concentrations in our population were higher than those reported for the U.S., Germany, and Canada. Median creatinine adjusted concentrations of the OP metabolites dimethyl phosphate and dimethyl thiophosphate) were higher in our population than in the U.S. and Canada, and comparable to those in France. Urinary BPA concentrations were higher in Jews than in Arabs or Druze (2.49, 0.82. and 0.89 µg/g creatinine, respectively; p = 0.02). BPA concentrations were higher in smokers, but not significantly (p = 0.055). Mushroom consumers had urinary BPA levels twice as high as nonconsumers (p = 0.03) in a multivariate analysis. Canned fish consumers had higher urinary BPA (2.36 µg/g) than nonconsumers (1.87 µg/g) but the difference was not significant. Females age > 44 y had higher urinary DAP concentrations for several metabolites. Fruit and vegetable intakes > 75th % were related to urinary diethyl phosphate metabolites, but not to dimethyl forms. In a multivariate model, total molar DAP levels increased with age, by a factor of 1.01 per year (p=.04), and were higher in subjects with high income compared to subjects with the lowest income by a factor of 1.59 (p=.02). Conclusions: These results will be used to formulate public health policies targeted at lowering exposures to BPA and OPs.

Abstract Number	**P-1-22-13**
Presenter	Ching-An Feng*, Chia tse Hung
Exposure	organic compounds
Health domains	respiratory disease
Type of research	occupational study

For GC/MS Identify Chemical Compounds of Coffee Roasting oil fume

The Coffee home roasting industry is booming in recent years; but the workers are also exposed to the inherent risk of the pollution, in the process of roasting coffee, because they inhale the oil fume without knowing it. The purpose of this study is to examine and analyze the effects of the oil fume to human health and then to make the recommendations to the industry on how to improve the working condition and reduce the risk of exposure to the oil fume in order to provide a safer and better working environment. A study was made on the oil fume of Brazil coffee beans, the most widely sold beans in world market. The oil fume is collected sep arately from roasting processes at 150 degree centigrade, 236-250 degree centigrade and 250 degree centigrade above. The Traditional method and the Solid-Phase Micro extraction method are used to collect oil fume sample. The traditional way is to connect individual high current pump with the glass fiber, the Acetone is used on the sample for extraction, then filtered, and compressed. GC/MSD/FID is used to analyze the oil fume chemistry contents. The other way applies the Polydimethylsiloxne/Divinylbenzene (PDMS/DVB) on DI-SPME-GC-MS for heat release analysis. The chemical analysis found a lot of chemical compounds. A comparison of the chemical compounds was done by using the online information provided by IARC & NLOM, and a possible carcinogenic was found as the result of the comparison. This study recommends the industry to maintain a good air circulation and have the workers wear mask to reduce the risk of exposure to oil fume.

Abstract Number	**P-1-22-14**
Presenter	Harris Kalyvas*, Pantelis Charisiadis, Constantinos Karaolis, Konstantinos C. Makris
Exposure	drinking water
Health domains	no health domain
Type of research	cross-sectional study

Influence of Household Disinfection Practices on the Magnitude and Variability of Urinary Bisphenol A Concentrations

Low-dose health effects of BPA have not been adequately explored in the presence of BPA metabolites of chlorinated or oxidized nature that may exert larger estrogenic effects (10-1000x) than those of their parent compound. We hypothesized that extensive use of chlorine disinfectant in households could modify the magnitude of total urinary BPA cocnentration measurements under certain exposure scenaria via the production of chlorinated BPA congeners. Our objective was to investigate the influence of typical household disinfection practices (shower/bath/laundry usage patterns, frequency and duration of household cleaning activites using chlorinated disinfectants, and household aeration patterns during disinfectant use) on the magnitude and variability of urinary BPA levels in a general population cohort (n=382) located in Nicosia, Cyprus. The study volunteers also completed a questionnaire about drinking water consumption habits, water source/uses, demographics, disinfectant use in household and medical history. Urinary BPA and trihalomethanes (THM) concentrations were measured with gas chromatography coupled with triple quadrupole mass spectrometry and large volume injection. Possible associations between urinary BPA and THM concentrations among participants will be determined, while the effect of the aforementioned household disinfection practices on the magnitude and variability of both urinary BPA and THM levels will be assessed using logistic multivariate regression analyses. The speculated effect of elevated exposures to residual disinfectant (chlorine) and its by-products (THM) will be investigated via monitoring of the total urinary BPA measurements for those individuals.

Abstract Number	**P-1-22-15**
Presenter	Sónia D. Coelho*, Ana Catarina Sousa, António J.A. Nogueira, Joon-Woo Kim, Tomohiko Isobe, Shinsuke Tanabe, Luís Taborda-Barata
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Levels of polybrominated diphenyl ethers, hexabromocyclododecanes and organophosphorus flame retardants in house dust samples from Portugal

Flame retardants are industrial chemicals added to flammable materials used in our everyday life (e.g. plastics, electrical/electronic equipment, carpets, wall coverings and textiles) in order to suppress or inhibit the combustion process and provide fire protection increasing the available time for escape. The most common classes of flame retardants include brominated flame retardants (BFRs), in which polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecanes (HBCDs) are included; and organophosphorus flame retardants (PFRs). Due to its toxicity and persistence, use of PBDEs has been banned in many countries, being replaced by HBCDs, PFRs and novel brominated flame retardants. Humans are regularly exposed to such chemicals being dust one of the most important exposure pathways. In the present work, levels of PBDEs, HBCDs as well as PFRs were quantified in house dust samples from two Portuguese cities by gas chromatography - mass spectrometry and ultra-high performance liquid chromatography - tandem mass spectrometry. The results obtained from 28 households suggest widespread contamination by flame retardants. Levels of total PBDEs ranged from 39 to 9600 ng.g-1 (median 340). Similarly to what have been reported by other studies, BDE209 was the major congener with values ranging between 24 and 9200 ng.g-1 (median 270) accounting for 78% of the total PBDEs quantified. Relatively high levels of BDE206, -207, -99 and -47 were also found in all samples analyzed. Levels of HBCDs ranged between 16 and 2000 ng.g-1 (median 150), with α-HBCD being the major isomer (56%) followed by γ-HBCD (32%). PFRs were also detected in all analyzed samples with values between 920 and 35000 ng.g-1 (median 3200) with tris (2-ethylhexyl) phosphate (TEHP) accounting for 44% of the total PFRs. The results obtained for Portuguese households are compared with the ones reported for other geographical locations and the estimated daily intake based on dust ingestion is also addressed.

Abstract Number	**P-1-22-16**
Presenter	Dong Pan, Julia Kuebrich, Glenn Morrison*
Exposure	household air pollution
Health domains	policy
Type of research	exposure measurement

Methamphetamine Contamination in Household Materials and the Effect of Skin Oil

The production of methamphetamine releases harmful chemicals into the air, which can then diffuse into and accumulate within the building structure. The risk to future occupants lies in the later ‘re-emission’ of chemicals from the building structure that lead to methamphetamine absorbing into furnishings, clothing, children’s toys. Soiling of personal items with skin oil can increase the absorption capacity, thereby increasing potential exposure to methamphetamine by dermal and oral routes. In this research, we exposed clothing, skin oil contaminated clothing, furnishings, and children’s toys to vapor phase methamphetamine in a laboratory chamber. By measuring the mass of methamphetamine absorbed in these materials, and the time required to approach equilibrium, we were able to determine the relationship between the concentration in air (40ppb) and that which will accumulate in furnishings, clothing, skin oil, and children’s toys. We found that skin oil might affect the time-dependent absorption of methamphetamine, although we did not observe a statistical difference at equilibrium on cotton clothing. Skin oil soiled cloth reached an equilibrium concentration of 25µg/100 cm2 ppb, while the clean cloth was over 15µg/100cm2/ppb for a 27 day duration of exposure. Different materials absorb different amounts of methamphetamine, ranging from an equilibrium value of over 50µg/100cm2/ppb for upholstery fabric to 3.75µg/100cm2/ppb for a fleece baby blanket for an exposure duration of 31 days. We predict that there is a risk of children ingesting more than the California reference dose of 0.3µg/kg/day if they are mouthing materials equilibrated with very low air concentrations of methamphetamine.

Abstract Number	**P-1-22-17**
Presenter	Kinga Lancz*, Lubica Palkovicova, Henrieta Patayova, Sona Wimmerova, Eva Šovcíková, Jana Chovancová, Beata Drobna, Tomáš Trnovec
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Novel approach to assessment of infant exposure to PCB 153 resulting from breast feeding

Background Human milk is an important carrier of PCBs and lactational transfer represents the primary route of PCB exposure to developing mammals. A measure of exposure of infants is the amount taken up into the body, commonly considered to be a product of the concentration of the compound in milk and the rate of consumption of breast milk or alternately duration of breast feeding. This approach is accompanied by many uncertainties originating from reporting on duration and exclusivity of breast feeding. Aims To create a valid relationship between concentration of PCB 153 in serum of breast fed infant and duration of breast feeding and to minimalize the influence of uncertainties in the reported data. Methods We started from data on lipid adjusted PCB 153 serum concentration in the following time intervals after birth: 0, 6, 16, 45 and 72 months and on maternal PCB 153 serum concentration at delivery. We included into the study 305 births during the period 2002-2003 from Michalovce districts in eastern Slovakia, an area polluted by PCBs. Serum PCB 153 concentration and breast feeding duration data were fed into a 4 parameter model approximating the concentration-time profile as described earlier (Trnovec T, et al. Chemosphere. 2011, 85:1687-93). Results The relationship between duration of breast feeding and PCB 153 serum concentration of the infant was described by a modified 3 parameters Weibull function. The PCB 153 serum concentration at termination of breast feeding was adjusted to PCB 153 concentration in cord blood serum to eliminate variability due to prenatal exposure. The postnatal PCB 153 serum concentration time course typically peaked when breast feeding ended which helped to discover discrepancies between real and data reported by mother on breast feeding period. Conclusions Our approach makes possible to predict reliably the PCB 153 concentration in infant's serum adjusted to cord blood concentration from breast feeding duration.

Abstract Number	**P-1-22-18**
Presenter	Vlasta Svecova*, Jan Topinka, Ivo Solansky, Radim Sram
Exposure	organic compounds
Health domains	respiratory disease
Type of research	cohort study

Personal exposure to carcinogenic polycyclic aromatic hydrocarbons and volatile organic compounds in the Czech Republic

Background: Benzo[a]pyrene and benzene are classified as proven human carcinogens.There are high concentrations of these pollutants in the eastern part of the Czech Republic. Aims: We measured personal exposures to carcinogenic polycyclic aromatic hydrocarbons (c-PAHs) boud to airborne PM2.5 (particulate matter ≤ 2.5 µm) and volatile organic compounds. Methods: Sampling was carried out in Ostrava, Karvina, Havirov and Prague. The active personal monitors PV1.7 for PM2.5 bound c-PAHs and passive diffusive samplers for VOCs were used. Only adult non-smokers participated in the study (N=160). All participants completed a personal questionnaire and a time-location-activity diary. Results: The average personal benzo[a]pyrene winter/summer exposures were: 6.9/0.6 in Karvina, 2.5/0.4 in Ostrava, 0.8/0.1 in Prague and 0.2 ng/m3 in summer in Havirov. We found outdoor concentrations, ETS, home heating fuel of coal, wood or gas, frequency of exhaust fan use, cooking and commuting by a car to be the main determinants of personal exposure to c-PAHs. The benzene, toluene, ethylbenzene, meta- plus para- xylene and ortho-xylene (BTEX) from VOCs were measured. The average personal BTEX exposure levels in both seasons were 7.2/34.3/4.4/16.1 µg/m3, respectively. The benzene levels were highest in winter in Karvina, Ostrava and Prague: 8.5, 7.2 and 5.3 µg/m3, respectively. The personal exposures to BTEX were higher than the corresponding stationary monitoring levels detected in the individual localities ($P<0.001$; except m,p-xylene in summer). The indoor environment, ETS, cooking, a home-heating fireplace or gas stove, automobile use and being in a restaurant were important predictors for benzene personal exposure. Conslusions: Results confirmed the high personal exposure to c-PAHs and benzene of Ostrava region residents. The multivariate models confirmed outdoor pollution as significant factor increasing the personal exposure of Ostrava study participants. Acknowledgements: FP7/ENV-2012-308524-2/CITI-SENSE, GA CR P 301/13/13458S.

Abstract Number	**P-1-22-19**
Presenter	Anahit Aleksandryan*, Artak Khachatryan, Bardukh Gabrielyan, Evelina Ghukasyan
Exposure	persistent organic pollutants
Health domains	other
Type of research	health impact assessment

Polychlorinated Biphenyls Transfer along the Trophic Chain in Hydroecosystems of Armenia

Background Polychlorinated biphenyls (PCBs) belong to the group of wide-spread organic compounds characterized by high toxicity, persistence and ability of long-range transfer. During the long years of PCBs use in industry world-wide, their huge amounts penetrated into environment and were involved in xenobiotics circulation in different media. Once penetrating the environment PCBs bioaccumulate and circulate in different matrices penetrating organisms of animals and humans through the tropic chains. Aims Studies were performed to reveal the actual state of PCB-related pollution and PCB transfer in hydroecosystems of the Republic of Armenia. Methods Revealing, identification and quantitative determination of individual PCBs were performed with the help of capillary gas-chromatography using the internal standard method on the electron-capture detector. Samples were taken from Sevan Lake (water, biomedia, bottom sediment) and different regions of Armenia (soil). Results Analyses of environmental samples demonstrated that PCBs were revealed in 100% cases. Average PCBs content in water from Sevan Lake made 0.727 mcg/L, while the maximum level was 6.831 mcg/L. In biomedia the average level of PCBs was 0.530 mcg/g and the maximum content was 0.743 mcg/g. In bottom sediment PCBs amounted to 1360.521 mcg/kg; maximum: 2166.052 mcg/kg. In soil samples PCB average value made 101.942 mcg/kg; maximum: 434.980 mcg/kg. Conclusion Research results indicated that PCBs were found in all studied matrices; moreover, PCBs content in bottom sediment and soil samples was a few dozens higher than in biomedia and water samples. This is consistent with their bioaccumulation and transformation features. The process of PCBs accumulation in hydroecosystems occurs mostly intensive. Depositing in bottom sediment, PCB residues are involved into the substances turnover by detritophages. Different hydrobionts accumulate PCB from the water environment. .

Abstract Number	**P-1-22-20**
Presenter	Peggy Reynolds*, Susan Hurley, Debbie Goldberg, Erika Garcia, David O. Nelson, Yunzhu Wang, Tan Guo, June-Soo Park, Weihong Guo, Myrto Petreas
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	cross-sectional study

Predictors of Serum PBDE Levels Among Older California Women

Background: One of the most striking features of the human PBDE exposure profile is the enormous variation between individuals, although little is known about specific predictors of body burden. Aims: As part of a study to identify disparities in body burden of PBDEs among participants in an on-going breast cancer study, we conducted a preliminary analysis of predictors of PBDE serum levels. Methods: Subjects included 289 disease-free female participants of the California Teachers Study (mean age=67; range 40-94 yrs.) who provided a 10-ml blood sample in 2011-2012 and completed a survey on potential sources of PBDE exposures. Serum samples were assayed for 19 PBDE congeners via Gas Chromatography/High Resolution Mass Spectrometry. To identify predictors of serum PBDE levels, age- and race-adjusted linear regression analyses were run for the three most common congeners (BDE-47, BDE-100, and BDE-153). Data were reported as ng/g lipid of serum and log-transformed prior to statistical analysis. Results: An inverse linear relationship with age was seen for all congeners but was only significant for BDE-153 ($p=0.01$). Compared to non-Hispanic white women (n=215), women of color (n=74) had significantly higher age-adjusted serum levels of BDE-100 ($p<0.001$) and BDE-47 ($p=0.01$) but not BDE-153 ($p=0.55$). Serum levels were also higher for all three congeners among women living in lower SES neighborhoods (BDE-47, $p=0.04$; BDE-100, $p=0.03$; BDE-153, $p=0.02$). Reported household factors did not predict BDE-47 or BDE-100, but higher levels of BDE-153 were found among women who reported their homes to have more sofas and stuffed chairs ($p=0.03$); more carpeting ($p=0.07$); and to be newly built (2000 or later ($p=0.05$)). Conclusions: There was modest evidence for higher levels of BDE-153 with some household factors, but the more striking evidence for a substantial disparity in body burden for women of color and those living in lower SES neighborhoods deserves further attention.

Abstract Number	**P-1-22-21**
Presenter	Hermann Fromme*, Thomas Lahrz, Martin Kraft, Ludwig Fembacher, Silvio Dietrich, Silvia Sievering, Rainer Burgardt, R. Schuster, Gabriele Bolte, Wolfgang Völkel
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Relevance of phthalates in indoor air and dust of German daycare centers (LUPE 3)

Background Phthalates are used as plasticizers in large quantities in numerous products and there are indications that they are associated with several health concerns. Aims / Methods Room air samples and settled dust from 63 daycare centers in Germany were analyzed for the presence of 15 phthalates in our study. Moreover, urine samples of 663 children were collected after they attended the facilities (Data presented in another abstract of the same working group [Kraft et al.]). Inhalable dust and gas phase were collected with a glass fiber filter and polyurethane foam over approximately 6 hours. Settled dust was collected by vacuuming the floor of the room using an ALK dust sampler. Indoor air and dust was analyzed using a GC/MS method whilst phthalate metabolites were analyzed with an LC-MS/MS system. Results Di-isobutyl phthalate (DiBP), di-n-butyl phthalate (DnBP), di-2-ethylhexyl phthalate (DEHP), and di-isononyl phthalate (DiNP) were present in the highest concentrations in the room air, with median values of 468 ng/m³, 227 ng/m³, 194 ng/m³, and 102 ng/m³, respectively. In dust, median values of 888 mg/kg for DEHP, 302 mg/kg for DiNP, and 21 mg/kg for DnBP were detected. On a median basis, DnBP and DiBP were responsible for 55% and DMP and DEP for an additional 20% of the total value in air, while DEHP and DiNP were responsible for 70% and 24% of the total concentrations in dust, respectively. No statistically significant differences were observed in rooms with PVC, wood or textile floor coverings or to the presence of a cozy corner or the amount of toys in the room. Conclusions We found high levels of phthalates in the dust of daycare centers. Although we observed for some phthalates significant correlations between the concentrations in air and dust and the excreted metabolites in urine, these results could not be confirmed for dust using multiple linear regression models. Airborne phthalate concentrations have a share of <13% of the total exposure of infants.

Abstract Number	**P-1-22-22**
Presenter	Stefanie Klenow*, Gerhard Heinemeyer
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Review of the occurrence of perfluorinated alkylated substances in house dust and evaluation of the exposure of toddlers to these compounds via house dust

Background and Aim: Perfluorinated alkylated substances are in focus of recent research activities because of their potential toxic properties and widespread occurrence in the environment. Within the frame of the PERFOOD project (KBBE-227525), an evaluation of exposure to perfluorinated alkylated substances from house dust has been performed by analysis of currently available literature in order to evaluate the importance of house dust as a carrier compared to the food pathway. Method: The evaluation has been focused on 16 different substances. Deterministic exposure estimations are based on average concentrations reported in house dust and standard assumptions of house dust intake from guidance documents. In addition, probabilistic calculations were done for PFOA based on publications that provide detailed information on the distribution of house dust concentrations. Results: The average exposure estimates considering median concentrations in house dust were 1 – 279 (PFBA), 2 – 2063 (PFBS), 1 - 44 (PFDA), 11 – 109 (PFDoDA), 6 (PFDS), 54 – 559 (PFHpA), 2 - 311 (PFHxA), 1 – 1379 (PFHxS), 7 - 132 (PFNA), 4 - 1724 (PFOA), 0.2 – 2756 (PFOS), 0.1 - 397 (PFOSA), 19 (PFTeDA), 39 (PFTrDA) and 7 – 868 (PFUnDA) (all in pg/kg b.w./d), showing the broad range of exposures. For PFOA, a detailed datasets in three publications allowed a probabilistic evaluation that also considered the range of house dust intake recommendations. Conclusion: A broad range of exposure via house dust was identified. The extent of the exposure estimates for each compound is not only a result of the widespread occurrence data in house dust but also based on the assumed amount of orally ingested house dust. The reliability of those data should be considered more in order to reduce the uncertainty in such assessments.

Abstract Number	**P-1-22-23**
Presenter	Tsuboi Tazuru*, Kawai Toshio, Atsuko Araki, Ait Bamai Yu, Tajima Shuji, Shi Cong, Kishi Reiko
Exposure	household air pollution
Health domains	allergies
Type of research	others

Simultaneous analysis of phthalate and organophosphate triesters' metabolites in urine -Exposure assessment to plastisizer and flame retardants and their risk o

Background: We have reported the method to simultaneous analysis of eight metabolites of five phthalates in urine in ISES2012. We have established simultaneous analysis of three metabolites of organophosphate triesters in addition to phthalate metabolites. Methods: Target metabolites were eight phthalate metabolites (MEHP, 5oxo-MEHP, 5cx-MEPP, 2cx-MMHP, MnBP, MBzP, MiBP, and MCPP) and three organophosphate triesters (BEHP metabolite of TEHP,DBP of TBP,and DPhP of TPhP). Sample preparation consists of 1. deconjucation with an enzyme; β-glucuronidase/arylsulfatase, 2. extraction with ethyl acetate, 3. dried by evaporation, 4. derivatization with N-Methyl-N-tert-Butyldimethylsilytrifluoroacetamide (MTBSTFA), and 5. GS/MS(SIM) analysis. A calibration curve was prepared by the simplified method of standard addition, that six different concentrations of standard solutions were spiked in urine (from 0 to 1.0µg/mL). Organophosphate trimesters were administered to mice and three main metabolites were examined. Results: Good linear correlations were obtained for eleven metabolites, and LOQs calculated as 10SD of five repeated measurement of standard solution in urine (0.01µg/mL) were between 0.006 to 0.053µg/mL. After deconjucation with an enzyme, concentration of phthalate metabolites were approximately 1.3 times higher than when deconjucation was not performed. On the other hand, concentrations of organophosphate metabolites were same levels at both with and without enzyme treatment.DBP was detected from urine samples of mice administered TBP, as well as DPhP from TPhP administered mice. However, BEHP was not detected from TEHP administered mice urine. Conclusion: Derivatization with MTBSTFA improves analytical sensitivity of simultaneous analysis. This research was supported by Environment Research and Technology Development Fund (C-1151) of the Ministry of the environment, Japan.

Abstract Number	**P-1-22-24**
Presenter	Janet Pan*, Ami Zota, Carrie Dickenson, Tracey Woodruff, Roy Gerona, Joel D. Schwartz
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	cross-sectional study

Sources of Bisphenol-A (BPA) Exposure among Ethnically Diverse, Lower Income Pregnant Women in Northern California

Background: The endocrine disruptor chemical BPA is a high production volume chemical used in various consumer products, with wide spread exposure among the U.S. population. Fetuses in early developmental stages are vulnerable to BPA disruption, and thus it is important to understand levels of maternal BPA exposure, sources of exposure, and degree to which free BPA is metabolized to its less potent conjugated metabolites BPA glucuronide and BPA sulfate in pregnant women. Objectives: To characterize sources of exposure to conjugated and free BPA among a low income, ethnically diverse population of pregnant women during their 2nd trimester of pregnancy. Methods: We measured BPA glucuronide, BPA sulfate, and free BPA in the urine of 2nd trimester pregnant women (n=112) using LC MS/MS. An original questionnaire was developed to identify dietary, non-dietary, occupational, and sociodemographic determinants of BPA exposure. Results: BPA was detected in 100% of participants and median concentrations (creatinine adjusted ug/g : BPA glucuronide 4.67, BPA sulfate 0.42, free BPA 0.25) were 2 times higher than the NHANES average. On average, composition of total BPA is 76% BPA glucuronide, 13% BPA sulfate, and 11% free BPA. BPA glucuronide and BPA sulfate levels are highly correlated, while no correlations were found between free BPA with BPA glucuronide or BPA sulfate. Both occupational and non-occupational receipts exposure were a strong predictor of conjugated BPA levels. Other predictors associated with higher BPA levels in multivariate regression analysis were higher educational attainment, non-African American race/ethnicity, canned food consumption, no wine consumption, and food processor use. Conclusions: We found higher than national average exposures in this under-studied population with BPA sulfate being an important metabolite. Consistent with other studies, our results suggest that dietary and occupational sources contribute to BPA exposure in pregnant women.

Abstract Number	**P-1-22-25**
Presenter	Susan A. Korrick*, Joseph Gardiner, Andrea Aguiar, Antonia M. Calafat, Susan Schantz
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Sources of Variability in Urinary Concentrations of Bisphenol A (BPA) and Phthalate Metabolites During Pregnancy

Background: Assessing exposure to bisphenol A (BPA) or phthalates for epidemiologic studies is challenging because these compounds have short half lives and exposure varies across hours and days. Consistent with these observations, repeat measures of urine BPA or phthalate metabolites have poor reproducibility over time, especially in pregnancy. Aims: To assess whether there are sources of variability in urine BPA/phthalate levels during pregnancy that are unrelated to exposure and that, when accounted for, improve reproducibility of these measures. Methods: Nineteen women (ages 18-40 yrs) from a prospective pregnancy cohort provided 6 first morning urine specimens between 17 and 37 weeks' gestation. Total BPA and metabolites of diethyl phthalate (DEP) and di-2-ethylhexyl phthalate (DEHP) were measured by high performance liquid chromatography-tandem mass spectrometry. Multivariable linear mixed models were used to assess the relation of log urine levels with pre-pregnancy weight, time since last void, time slept and gestational age and weight gain at each urine collection. A random effects model was used to calculate intraclass correlation coefficients (ICCs) among repeat urine measures with and without adjustment for predictors in multivariable models. Results: Specific gravity adjusted urine levels of BPA, monoethyl phthalate (MEP) and ∑DEHP metabolites ranged from 0.40-7.60 µg/L, 7.76-1,740 µg/L and 0.02-5.60 µmol/L, respectively. After adjustment for the above covariates, ICC values changed from 0.26 to 0.37 (BPA), 0.69 to 0.68 (MEP), and 0.33 to 0.36 (∑DEHP metabolites). Conclusions: This study's ICCs were substantially higher than those reported in other pregnant populations. Adjustment for potential sources of random variability in urinary excretion modestly improved BPA, but not phthalate, reproducibility. Population differences in exposure sources and timing of urine collection (e.g., random vs. 1st morning) may be important determinants of reproducibility of these measures.

Abstract Number	**P-1-22-26**
Presenter	Toshihiro Kawamoto*, Mayumi Tsuji
Exposure	organic compounds
Health domains	allergies
Type of research	health impact assessment

Specific antibodies against plastic resins

Background:Structural changes of our body proteins caused by the binding of chemical substances are one of the most important mechanisms of allergy onset. Aims: It is aimed to clarify the diagnostic meaning of serum specific antibodies against plastic resins. Methods: the fluorescence of human serum albumin (HSA) was studied after mixing with various chemicals. The antigenicity of chemical-HSA adducts toward sera from sensitized patients was varied according to the condition in which adducts were formed. An effective method to detect antibody against chemical-HSA adducts were developed by utilizing light capture. The presence of the antibodies against chemical-HSA adducts were compared between workers with and without allergic dermatitis, who were handling plastic resins. Results: When HSA was mixed with sensitizing chemical substances, the fluorescence of HSA decreased dose-dependently. The reduction of HSA fluorescence by treatment with chemicals was by the following order; commonly designated sensitizers > possible sensitizers > non-sensitizers. HSA fluorescence after treatment with test chemicals may be a good predictor for their sensitizing potentials. The antigenicity of chemical-HSA adducts toward sera from sensitized patients was varied according to the condition in which adducts were formed. An effective method to detect antibody against chemical-HSA adducts were developed by utilizing light capture. The presence of the antibodies against plastic resin-HSA adducts were compared between workers with and without allergic dermatitis, who were handling plastic resins. Eight of 10 workers who were suffering from allergic dermatitis had specific antibody against the plastic resin. Two of them were negative. In contrast, the number (ratio) of the specific antibody-positive workers among 9 workers who had no symptoms was 3 (33.3%). The sensitivity was 80%, the specificity was 67%. Conclusions: Specific antibodies against chemical-HSA adducts will be good biomarkers for plastic resin allergy.

Abstract Number	**P-1-22-27**
Presenter	Shelley A Harris*, Beatrice Boucher, Caryn Thompson, Cariton Kubwabo, Michelle Cotterchio, Julia Knight, Len Ritter, Paul J Villeneuve
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	exposure measurement

The development of a comprehensive exposure assessment strategy for polybrominated diphenyl ethers (PBDEs) for use in observational epidemiology studies.

Background: Polybrominated diphenyl ethers (PBDEs) are a group of flame retardants added to consumer products such as electronics, textiles, polyurethane foam and appliances. They are persistent chemicals increasing in the environment and have contaminated the food chain. Some are endocrine disruptors and toxicological evidence indicates they may increase the risk of certain cancers, including breast cancer. Aims: Our aim was to develop a PBDE exposure assessment strategy for use in epidemiology studies, including the Ontario Environment and Health Study, a population-based case-control study of breast cancer in Canadian women, aged 18-39 years. Methods: To evaluate the routes and sources of PBDE exposures, and their relative importance, the published literature was searched using Medline (1996-2012) and Embase (1980-2010). A Google search was used to identify grey literature. The literature was summarized and exposure sources were prioritized. Previously developed questionnaires and exposure assessment strategies were also reviewed. Results: Dust ingestion, dermal absorption, and hand-to-mouth contact were identified as important routes of exposure. Major dietary sources include poultry, red meat, fatty fish, and fish oils. Occupational sources and air travel contribute to exposure. A questionnaire was developed to obtain occupational and environmental exposures and factors such as housing characteristics. To capture potentially important dietary sources, the Block 2005 food frequency questionnaire was modified, and a PBDE database will be developed. To evaluate absorbed dose, serum and urine will be collected and placed in a Biobank. Serum will be analyzed for PBDE congeners. Plans are underway to collect air, dust, and surface wipes in 51 homes, to be used for validation. Conclusions: A comprehensive exposure assessment strategy allows us to: evaluate associations between PBDE exposures and breast cancer (with serum biomarkers), understand sources of exposure measurement error (based on questionnaires), and identify important sources of human exposure.

Abstract Number	**P-1-22-28**
Presenter	Lucie Anzivino*, Laure Dossus, Jeffrey Blain, Elodie Faure, John R. Nuckols, Virginie Chasles, Françoise Clavel-Chapelon, Béatrice Fervers
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	exposure modeling

Using the UNEP Toolkit to estimate environmental dioxin exposure in the GEO3N study

Background : Dioxins are produced during incomplete combustion of chlorine compounds in several industrial processes. They are suspected to play a role in the development of hormone-related cancers such as breast cancer. Aims : The Geo3N project aims to analyse the relation between environmental dioxin exposure from multiple sources and breast cancer in the French E3N cohort. A pilot study is conducted in the Rhône-Alpes Region (France). To estimate dioxin exposure through a geographic information system (GIS), a first step aims to make an inventory of dioxin emissions from 1990 to 2008. Methods : Inventory of relevant sources and dioxin emissions through public and institutional information sources were performed. We used the United Nations Environment Programme (UNEP) Toolkit for Identification and Quantification of Dioxin and Furan Releases to assess relevant sources known to release dioxins and estimate annual dioxin emissions. Results : Based on the Toolkit, more than 200 relevant industries and activities in the Rhône-Alpes Region were included and detailed information on key parameters gathered (exact location, activity periods and levels, process characteristics and technologies). For some sources and periods, reliable data were lacking or nonexistent, in particular for closed sites and no measured releases were available prior to 1997 for larger plants. Based on the default UNEP emission factors, we estimated dioxin emissions for the 200 sources identified in the Rhône-Alpes Region and compared them when available, with dioxin release data. Source characteristics and emission estimates were reviewed by a panel of 8 experts. We will present and discuss results of applying the UNEP Tollkit to France to estimate dioxin releases from multiple sources. Conclusion : Although default emission factors may be prone to uncertainties, the Toolkit provides a standardized methodology, to estimate dioxin emissions. Combined with a GIS, it will contribute to improve characterization of dioxin exposures in epidemiology study design.

Abstract Number	**P-1-24-01**
Presenter	Berrin Serdar*, Jibanananda Mishra
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	cross-sectional study

An inverse association between serum PCB levels and immune cell count in the general population

Background Polychlorinated biphenyls (PCBs) are persistent organic pollutants that are widely distributed in the environment, with detectable amounts observed in blood samples from the general population. PCBs are grouped as probable human carcinogens and have been linked to hepatotoxicity, dermal effects, reproductive and endocrine effects. Limited information from human studies suggests that PCBs may suppress the immune system. Aims To investigate the association between serum PCBs and immune cell numbers among samples from the general population. Methods Lipid-adjusted serum concentrations of PCBs, blood cell count (lymphocyte, basophil, eosinophil, monocyte, segmented neutrophils and white blood cells) and interview data were obtained from the 2003-2004 National Health and Nutrition Examination Survey (NHANES). Statistical tests were performed using SAS system software (SAS Institute, NC) using appropriate sample weights with the Survey Procedures (PROC SURVEYMEANS, PROC SURVEYREG). Correlation between PCB levels and blood cells were examined using weighted Pearson correlation coefficients (PROC CORR). Results Serum PCB levels were available for 1817 to1898 participants. Basophils and eosinophil counts were not associated with PCB levels. We observed statistically significant negative associations between measurements of lymphocytes, monocytes, neutrophils and PCBs. Strongest negative correlations were observed between lymphocyte counts and PCBs, particularly PCBs with higher number of chlorine atoms (Pearson r between -0.084 and -0.174, p <0.0001). Conclusions Our results suggest an inverse association between the number of peripheral blood lymphocytes, monocytes, neutrophils and PCBs. This is consistent with previous findings that PCB exposures may modify immune cell numbers and depress the immune system in humans. Further analyses will examine potential associations between PCBs and measures of immune function.

Abstract Number	**P-1-24-02**
Presenter	Anna Jeng*, Chih-Hong Pan, Wen-Yi Lin
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	cross-sectional study

Association between polycyclic aromatic hydrocarbons exposure and sperm DNA ingetrity

The objective of this study was to examine sperm DNA integrity of coke-oven workers in relation to exposure to polycyclic aromatic hydrocarbons (PAHs) from the coke processing. A total of 72 human subjects participated in this study: 24 topside-oven workers, 28 side-oven workers, and 20 administrative personnel serving as the high exposure group, low exposure group, and control, respectively. An exposure assessment was conducted to depict the extent of PAH exposure by measuring urinary 1-hydroxypyrene (1-OHP). DNA fragmentation, 8-oxo-7,8-dihydro-2'-deoxyguanosine (8-oxodGuo), and bulky DNA adducts in sperm DNA were quantified using terminal deoxynucleotidyl transferase-mediated dUTP nicke end-labeling, liquid chromatography-mass spectrometry/mass spectrometry , and 32P-labeling, respectively. Coke-oven workers had increased levels of DNA fragmentation, 8-oxodGuo, and bulky DNA adducts. However, there was no significant difference on DNA fragmentation levels among the three studied groups (P = 0.062), while the levels of 8-oxodGuo and bulky DNA adducts were significantly higher than those of the control (P = 0.048 and 0.032, respectively) with controlling for age, alcohol consumption, and smoking. DNA fragmentation positively correlated with 8-oxodGuo, which suggests that oxidative stress may link with DNA breakages. Urinary 1-OHP levels did correlate with 8-oxodGuo levels (P = 0.036), but not bulky DNA adducts and DNA fragmentation. In summary, exposure to PAHs linked to oxidative damage and formation of DNA adducts in sperm. Monitoring of sperm DNA integrity is recommended for affected workers as part of periodic health assessment to determine the impact of occupational toxins on sperm.

Abstract Number	**P-1-24-03**
Presenter	Sung-Ho Kim*, Miyoung Yang, Su Ryeon Noh, Young-Hyun Choi, Yong Jin Jeon, Gwi Heum Eom, Hyun Sook Bae, Jung Ah Kim, Mina Ha, Hae-Kwan Cheong
Exposure	organic compounds
Health domains	other
Type of research	others

Biological Responses in Rats Exposed to the Hebei Spirit Oil Spill Constituents

Background : The Hebei Spirit Oil Spill, the largest oil spill in Korea, occurred in December 2007,. Many crude-oil components are well-known potential carcinogens and developmental toxicants. Aims : To evaluate the acute to chronic effects of crude oil exposure on hematological and blood biochemical toxicities. Methods : Sprague-Dawley rats were given oral doses of 0, 50 or 100 mg/kg BW/day of Iranian heavy crude oils for four weeks. Results : In the acute phase of exposure (one day after four weeks of oil treatment), decrease in the weight of thymus, serum level of interferon gamma (IFN-γ), superoxide dismutase (SOD) and catalase activities in liver or kidney was found, and increase in the weight of adrenal gland occurred after the oral administration of crude oil. In body weight, histopathological examination, hematological, and blood biochemical analyses in the acute phase of exposure, there were no significant differences among the experimental groups. In the subchronic and chronic phase of exposure (two months and six months after four weeks of oil treatment), the changes of biomarkers were normalized except for the indicators of oxidative stress. Conclusions : Our findings show that the bioassay on the indicators of oxidative stress is a sensitive method for determining exposure to crude oil in rats.

Abstract Number	**P-1-24-04**
Presenter	Erik Lampa*, Lars Lind, P. Monica Lind, Anna Bornefalk Hermansson
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Boosted regression trees – a way to study mixture effects of environmental contaminants measured in the circulation.

Background Mixture effects of environmental contaminants are of great concern to the public health. Several experiments in the literature have demonstrated effects of combinations of environmental contaminants that exceed the individual effects of the contaminants. Mixture effects can be described as interaction terms in regression models and there is a need for methods to uncover these effects in epidemiological data. Aims To assess the ability of boosted regression trees to uncover complex interaction effects in simulated data. Methods The simulated data was based on real data from the PIVUS study which has 37 environmental contaminants representing different classes measured in the circulation in 1,016 individuals aged 70. We assumed log-normal distributions for the contaminants and allowed some contaminants to correlate to mimic the correlation seen among PCBs in humans. A target function containing a four-way interaction plus a highly non-linear term was generated and random noise was added. The random noise was normally distributed with standard deviations yielding signal-to-noise ratios of 2, 1, 0.5 and 0.1 to reflect different strengths of association. Results The four-way interaction was correctly identified in all cases except for the smallest signal-to-noise ratio. The non-linear effect was correctly captured in all cases. Conclusions Boosted regression trees may be useful for uncovering mixture effects of environmental contaminants in epidemiological data.

Abstract Number	**P-1-24-05**
Presenter	Johanna Penell*, Lars Lind, Tord Naessen, Jonas Bergquist, Mark M. Kushnir, Bert van Bavel, Samira Salihovic, P. Monica Lind
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cross-sectional study

CIRCULATING LEVELS OF PCBs AND SEX HORMONES IN A POPULATION-BASED SAMPLE

Background: PCBs have been widely used in the environment and high levels are still found in humans. Although some of the PCBs are regarded as Ah-receptor agonists, effects on reproductive organs have been reported, suggesting effects of PCBs on the biosynthesis of steroids. Aims: We have now evaluated the relationships between circulating levels of PCBs and sex hormones in humans. Methods: Plasma samples from 1000 70-year-olds were analyzed as part of a large population-based study (Prospective Investigation of the Vasculature in Uppsala Seniors). Eleven sex steroids were quantified, using liquid chromatography-tandem mass spectrometry (LC-MS/MS) and PCBs (PCB118, 126, 156, 169, 170 and 206) were measured with high-resolution GC/MS. Women with current/previous menopausal hormone therapy were excluded from the data analysis. Results: Concentrations of two dioxin-like PCB (PCB118 and PCB156) and one non-dioxin-like PCBs (206) were inversely related to levels of testosterone (in women only, $p<0.05$). Two of the non-dioxin-like PCBs (PCB170 and 206) were furthermore inversely related to estradiol levels in women only ($p<0.005$). Conclusions: In samples of elderly, concentrations of circulating PCBs were associated with concentrations of sex hormones. Physiological effects of different PCBs are likely different and their association with steroidogenesis should be studied.

Abstract Number	**P-1-24-06**
Presenter	Huey-Jen Su, Chia-Wei Lee, Chien-Cheng Jung, Nai-Yun Hsu, Chih-Hsiang Yang, Chien-Lin Huang*, Cheng-Tao Wang, Tsung-Kuan A Chou, Li-Peng Wang
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Comparison of Three VOC Measurement Techniques for tVOC Monitoring Regulated by Taiwan EPA in Indoor Air Quality

Background: The Indoor Air Quality (IAQ) regulation has been enforced in Taiwan since November 2012: including CO2, CO and total volatile organic compounds (tVOCs). The tVOC is defined as the concentration summation of 12 specific VOCs according to Taiwan Environmental Protection Agency's (Taiwan EPA) guideline. There are many portable sensors on the market for measuring CO and CO2 concentration. However, a portable on-site tVOCs monitoring device which can accurately measure the tVOCs concentration is yet to be verified. Aims: This study aims to evaluate a reliable direct on-site tVOCs monitor approach in compliance with the regulation by Taiwan EPA guidelines. Method: The study was done by analyzing the tVOCs from 4 residential rooms in Taiwan using 2 portable devices: ppbRAE PID and MiTAP-IAQ (by TRICORNTECH Corp.). The ppbRAE PID is based on photo-ionization technique, detecting VOCs ionized by the UV light. The MiTAP-IAQ device is developed to detect the 12 specific VOCs in Taiwan IAQ regulation. In additional, the air samples at each corresponding test site were collected by 1-hour canister sampling and then subsequently analyzed using Environmental Analysis Laboratory A715.14B method by GC/MS. The reference tVOC concentrations were obtained by summation of the 12 specific VOCs of interest. Finally, the tVOC concentrations measured by those2 portable devices were compared to the reference tVOC values respectively to verify their accuracy. Results: The results of 4 field samples by MiTAP-IAQ were linearly correlated with those by A715.14B method. On the contrary, the results by the ppbRAE showed significant reading fluctuation ranging from 19% to 104%. Meanwhile, the PID's 1-hour average results showed no correlation with those by A715.14B method. Conclusion: Preliminary data suggest that the portable MiTAP-IAQ demonstrated its linear correlation results with the A715.14B method, providing a potentially reliable on-site tVOC monitoring option for Taiwan IAQ applications.

Abstract Number	**P-1-24-07**
Presenter	Ellen Wells*, Leila W. Jackson, Michaela B. Koontz
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

Cross-sectional analysis of bisphenol A with blood pressure among children

Background: Bisphenol A (BPA) is an estrogen mimic. Prior work has identified a cross-sectional association between BPA and blood pressure (BP) and similar outcomes among adults; however, whether this is also true for children is unknown. Aim: Assess the cross-sectional relationship of BPA and BP percentile among children. Methods: This study was a cross-sectional analysis of 2744 children aged 8-19 years participating in the National Health and Nutrition Examination Survey from 2003-2010. Subjects completed interviews, physical examinations and provided biological samples. BPA was determined using mass spectrometry on a spot urine sample. Three BP measurements were taken by trained study staff. Their average was transformed into BP percentiles and categories, in accordance with published guidelines for childhood BP. All analyses accounted for the complex survey design and incorporated appropriate survey weights. Multivariable linear (BP percentile) and multinomial (BP category) models adjusted for age, sex, race/ethnicity, parental education, body mass index percentile and smoking status. Results: In this population, geometric mean BPA was 2.57 ng/mL (95% confidence interval (CI): 2.42, 2.72); systolic and diastolic BP percentile were 44.3 mmHg (42.5, 46.1) and 34.6 mmHg (32.5, 36.7), respectively. 4.3% (3.2, 5.3) of children were prehypertensive and 2.6% (1.8, 3.4) were hypertensive. No relationship between BPA and BP percentile or category was observed. In adjusted models, children in the highest quartile of BPA exposure compared to those in the lowest had a -0.41 mmHg (-4.41, 3.58) change in systolic BP percentile; -2.71 (-7.57, 2.15) change in diastolic BP percentile. Similar results were observed for BP category. Conclusions: In contrast to prior work among adult cohorts, we did not observe an association between BPA and BP among children; possibly because insufficient time to develop elevated BP has elapsed for these children.

Abstract Number	**P-1-24-08**
Presenter	Matthew Lorber*, Holger M. Koch
Exposure	organic compounds
Health domains	neurodevelopment
Type of research	exposure modeling

Development and Application of Simple Pharmacokinetic Models to Study Human Exposure to Di-n-butyl phthalate (DnBP) and diisobutyl phthalate (DiBP)

In a controlled dosing experiment, a single individual consumed 5 mg each of labeled di-n-butyl phthalate (DnBP) and diisobutyl phthalate (DiBP) on separate occasions and tracked metabolites in his blood and urine over 48 hours. Published data from this study was used to structure and calibrate simple pharmacokinetic (PK) models for these 2 phthalates, which predict urine and blood metabolite concentrations with a given phthalate intake scenario (times and quantities). The calibrated models were applied to a second experiment in which 5 individuals fasted over the course of a 48-hr weekend (bottled water only), and their full urine voids were captured and measured for DnBP and DiBP metabolites. One goal of this model application was to confirm the validity of the calibrated models – their validity would be demonstrated if a profile of intakes could be found which adequately duplicated the metabolite concentrations measured in the urine. A second goal was to study patterns of exposure for this cohort. It was found that all metabolites could be duplicated very well with individual-specific “best-fit” intake scenarios. For all 5 individuals, the reconstructed dose profiles of the two phthalates were similar: about 6 small bolus doses per day and an intake of about 0.5 µg/kg-day. The intakes did not appear to be associated with diary-reported activities (personal hygiene and medicine) of the participants. All reconstructed intakes of DnBP and DiBP occurred at exactly the same times, suggesting similar (if not the exact same) sources of exposure for these two phthalates. The modeled frequent intakes suggested one (or both) of two possibilities: ongoing exposures such as an inhalation exposure, or no exposure but rather an ongoing release of body stores of the phthalate metabolites from past exposures.

Abstract Number	**P-1-24-09**
Presenter	Gilmar Sidnei Erzinger*, Luciano Henrique Pinto, Lineu Fernando Del Ciampo, Luana Soares Schulter, Rafaela Sierth Sierth, Marcela Cristina Fausto Teixeira, Heloisa Biff, Bianca Ramos Pezzini
Exposure	organic compounds
Health domains	other
Type of research	health impact assessment

EMERGING POLLUTANTS: ENVIRONMENTAL IMPACT OF DISPOSAL OF DRUGS

Background The term "pollutant emergent" refers to any type of contaminant which originated from previously undetected pollutants or products that were not deemed problematic to health and the environment. This group of pollutants includes products for veterinary use, personal care products, and pesticides. Pharmaceuticals in the aquatic environment should be identified as they reach the environment through discharges or excretion in an unaltered form by animal organisms. The greater attention given to this emerging type of pollutant occurs through both an increasing incidence of these concentrations in the environment, and an increase in studies which have demonstrated the health risks that these products can cause in cases of long-term exposure. Aims The aims of this study was to evaluate different pharmaceutical compounds are biologically active substances that are persistent and are recognized as a permanent threat to environmental stability.The drugs were evaluated statins, oral contraceptives and fluxetine. Methods Tests were conducted acute and chronic to the algae Euglena gracilis with the equipment is the NGTOX® which uses a system of image analysis and real time points with up to 10 possible physiological variations and the microcrustaceansDaphnia magna. Results, The qualitative and quantitative determination of pollutants by instrumental analyses are of utmost importance, but there is a current emphasis on the environmental impacts on living beings in the medium and long term through ecotoxicological tests. The results showed that the microorganisms studied exhibited physiological changes and reproducing significant in tests with results of chronic loss of reproductive capacity and motility (Daphnia and Euglena) and reduction in the capacity of photosynthesis (Euglenas) and inhibition of gravitactic orientation. Conclusions Subsequent to these improvements in defining potential targets the possibility of devising scientifically-based testing strategies for the detection, identification and quantitation of ecotoxicological should consequently allow a much better risk estimation for the environmental part of the whole drug assessment process and ultimately lead to a better understanding of the potential influence of drugs on the environment.

Abstract Number	**P-1-24-10**
Presenter	Astrid Heiland*, Gerhard Heinemeyer, Christine Sommerfeld, André Conrad
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	exposure modeling

Estimating and Evaluating the Total Exposure of German Children to Di(2-ethylhexyl) phthalate (DEHP) and Di-isononyl phthalate (DINP)

Background: Being associated with adverse health effects, the human exposure to DEHP and DINP is subject of concern. For adults, food is the main source of exposure. However, for children, additional sources of DEHP exposure must be taken into account. Methods: Our exposure modelling study comprised a review of data on DEHP and DINP in food, consumer products, and house dust. This includes published data as well as current measurements of DEHP and DINP in consumer goods (concentration and migration) and selected foods. Non-intended contact with consumer products via "mouthing" is of particular importance. Mouthing times used in this project have been derived from a joint evaluation of studies coming from the literature. The exposure via all pathways was estimated using deterministic and probabilistic approaches. Results: Diet contributes most to the total exposure, followed by mouthing and house dust intake. Mouthing is estimated to cause an exposure to DEHP of 0.9 (P50) / 10.8 (P95) and 3.9 µg/(kgbw d) using probabilistic and deterministic calculations, respectively. Calculations for DINP lead to comparable estimates. The exposure to DEHP via house dust is estimated to be 2.3 (P50) / 4.7 (P95) by the probabilistic model and 1.4 - 6.8 µg/(kgbw d) when applying deterministic calculations. The exposure to DINP via house dust is estimated to be approx. 25 % lower than for DEHP. Conclusions: On average German children are exposed to DEHP/DINP below the current TDI. For a small fraction of the population, however, TDI exceedance cannot be excluded due to unfavourable exposure conditions. Mouthing can be assumed to contribute significantly to children's total exposure. Different uncertainties exist for the respective sources and paths of exposure. Current data on DEHP and DINP in non-regulated consumer products are scarce, which warrants further monitoring. Funding by the Federal Minister for the Environment, Nature Conservation and Nuclear Safety is gratefully acknowledged.

Abstract Number	**P-1-24-11**
Presenter	Thu Quach*, Erika Garcia, Swati Sharma, Michelle Pierce, Sushma Bhatia, Sania Tong Argao, Kim Hoang
Exposure	organic compounds
Health domains	other
Type of research	occupational study

Evaluating a County-based Healthy Nail Salon Recognition Program

Background: Chemical exposures are of high concern for nail salon workers who handle nail care products containing many hazardous compounds including some linked to cancer, reproductive harm, and respiratory problems. In response, the city of San Francisco (SF), California passed a ground-breaking ordinance to establish a voluntary recognition program for salons that use nail care products without certain toxic compounds. For salon recognition, workers must undergo safety training and the salon receives site visits to determine that safer alternative products are being used. Aims: To determine whether nail salons that participate in the SF recognition program have reduced measured levels of toluene, methyl methacrylate, and total volatile organic compounds (TVOC) as compared to nail salons that do not participate, and to evaluate changes in worker knowledge and behaviors. Methods: We conducted personal air monitoring using passive organic vapor monitors and administered surveys to assess the knowledge and behaviors of two workers per salon (n=22) from each of six nail salons that participated in the SF program (intervention group) and five comparison salons that did not participate. We conducted these assessments with both groups before and after the completion of the training program for the intervention group. Results: There were no statistically significant differences in measured levels of air contaminants between the two groups. Although not significant, there was a reduction in toluene (-46% vs. 0%) and TVOC (-19% vs. +47%) levels in the intervention group as compared to the comparison group, respectively. There was a statistically significant knowledge increase for chemical awareness (+50%) and appropriate glove use to protect against chemicals (+58%) for the intervention group between pre- and post-training surveys. Conclusions: A government-based nail salon recognition program may have some positive impacts on salon air quality and work-related knowledge.

Abstract Number	**P-1-24-13**
Presenter	Maryse F Bouchard*, Oulhote Youssef, Sagiv Sharon, Dave Saint-Amour, Jennifer Weuve
Exposure	persistent organic pollutants
Health domains	neurodegeneration
Type of research	cross-sectional study

Exposure to Polychlorinated Biphenyls and Cognition in Older U.S. Adults: National Health and Nutrition Examination Survey (1999-2002)

Background: Polychlorinated biphenyls (PCBs) are ubiquitously present in tissues of human populations because of their resistance to degradation and accumulation in fatty tissues. PCB body burden increases with age, yet data on neurotoxic effects in older adults is limited. Aims: To examine the cross-sectional association between serum PCB concentrations and cognitive function in older adults from the general U.S. population, and explore sex- and age-related differences in this association. Methods: We analyzed data from 708 respondents, ages 60 to 84 years, participating in the National Health and Nutrition Examination Survey (1999-2002). Cognitive function was assessed with the Digit Symbol Coding test. We examined the association between cognitive scores on a continuous scale and lipid-adjusted PCB concentration in serum, for dioxin-like, non-dioxin-like, and the sum of all ten measured congeners. All analyses were adjusted for education, race/ethnicity, and poverty-income ratio. Results: The median concentration of lipid-adjusted PCBs in serum was 271 ng/g (interquartile range, 193-399 ng/g). Serum PCB concentrations of dioxin-like and non-dioxin-like congeners were not significantly associated with cognitive score, but there was a significant interaction between dioxin-like PCB concentration and age (p=0.04). Age-stratified anaysis showed that an increase of 100 ng/g in dioxin-like PCB serum concentration was associated with a difference of -2.7 points in score (95% CI, -5.1 to -0.2, p=0.04) in individuals ages 70 to 84 years, but there was no significant association among those 60 to 69 years. Furthermore, the deleterious association was more pronounced in older women, with a difference of 7.9 points between the lowest and highest exposure tertiles, equivalent to the difference between women 8.8 years apart. Conclusions: The present findings support the hypothesis that PCB exposure has adverse cognitive effects, though perhaps only with advanced age.

Abstract Number	**P-1-24-14**
Presenter	Wenjuan Wei*, Cynthia Howard-Reed, Andrew Persily, Yinping Zhang
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Formaldehyde emissions from a LIFE reference: emission parameters and factorial studies

A formaldehyde liquid-inner tube diffusion-film-emission (LIFE) source was developed to evaluate the performance of chamber systems for furniture/building material formaldehyde emission tests consisting of a formaldehyde-water solution tube and a polydimethylsiloxane (PDMS) film. The measurements of the formaldehyde LIFE source's emission rate and the PDMS film's key emission parameters (diffusion coefficient and partition coefficient) were made under various temperatures (10 ℃, 23 ℃ and 30 ℃). In this paper, the relation between the PDMS film's emission parameters and temperature were investigated, and correlations between these parameters and temperature were established. The equivalent emission parameters (diffusion coefficient, partition coefficient, and initial emittable formaldehyde concentration) of the LIFE reference, fitting the LIFE reference as a one dimensional emitting building material, were determined by the sequential quadratic programming (SQP) method. Experimental correlations between the equivalent emission parameters of LIFE and temperature were also studied by fitting the data of the equivalent emission parameters of LIFE to the correlations for building materials, which were also well matched. The results show that the formaldehyde LIFE source can be used to evaluate the performance of a chamber system for determining formaldehyde emission rates from furniture/building materials and also evaluate key material parameters affecting emissions.

Abstract Number	**P-1-24-15**
Presenter	Aiguo Ren*, Yue Yuan, Xinghua Qiu, Lei Jin, Tong Zhu, Zhiwen Li, Le Zhang
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	case-control study

Levels of PAHs and PAH-DNA Adducts in Placental Tissue and the Risk of Fetal Neural Tube Defects

Background: Neural tube defects (NTDs) are amongst the most common and serious birth defects that affect approximately 324,000 births worldwide annually. Environmental exposures, in addition to genetic factors, contribute to NTD etiology. However, human studies using exposure biomarkers have been sparse. Aims: We examined the relationship between levels of polycyclic aromatic hydrocarbons (PAHs) and PAH-DNA adducts in the placental tissue and the risk of fetal NTDs. Methods: Placental tissues from 80 NTD-affected pregnancies and 50 uncomplicated normal pregnancies were included in this case-control study. PAHs in placental tissues were quantified by GC/MS, and PAH-DNA adducts by a 32P-postlabeling assay. We examined the relationship between levels of PAHs and PAH-DNA adducts in the placental tissue and the risk of fetal NTDs. We further explored the interaction between placental PAHs and PAH-DNA adducts with respect to NTD risk. Results: PAH levels (median: 597 vs. 392 ng/g lipid weight) were higher while PAH-DNA adduct levels (median: 8.12 vs. 9.92 per 108 nucleotides) were lower in the NTD group compared to controls. PAH-DNA adduct concentrations below the median was associated with a 3-fold increased NTD risk. Women with a low PAH-DNA adduct level in concert with a high placental PAH level resulted in a 10-fold elevated risk of having an NTD-complicated pregnancy. Conclusions: A high level of placental PAHs but a low level of PAH-DNA adducts was associated with an increased risk of fetal NTDs; this risk increased dramatically when a low adduct level was coupled with a high placental PAH level.

Abstract Number	**P-1-24-16**
Presenter	Mengyan Gong*, Charles Weschler, Yinping Zhang
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Measuring phthalate concentrations in skin surface lipids

Phthalates are common indoor pollutants. Higher molecular weight phthalates arewidely used as plasticizers, while lower molecular weight phthalates are commonly used as solvents in personal care products and perfumes. Certain phthalates may function as endocrine disruptors and have been associated with various adverse health effects. Better understanding of exposure to phthalates via the dermal pathway will contribute to strategies to reduce aggregate phthalate exposures. The aims of the present study were to investigate (1)the skin surface concentrations of phthalates at different locations on the body, and (2) the impact of hand washing on skin surface concentrations. In preliminary experiments, six commonly used phthalates (DMP, DEP, DiBP, DnBP, BBzP, DEHP) were measured in skin wipes from the forehead, forearm, palm and back-of-hand of nineadult volunteers. The skin wipe data were analyzed using the non-parametric Mann-Whitney U test. In all of the skin wipe samples, the level of DMP was below the method's limit of detection. DEP was detected in only one forehead sample (29 ug/m2). BBzP was detected in 5 samples (10 ~ 851 ug/m2). DEHP, DiBP, and DnBP were the dominant phthalates in the skin wipes with median levels of, respectively, 3450, 205, 309 ug/m2 for the palm; 1707, < 29, < 46 ug/m2 for the back-of-hand; 552, 20, < 17 ug/m2 for the forearm; and 879, < 86, < 52 ug/m2 for the forehead. At all locations, DEHP concentrations were larger than those of DiBP and DnBP. DEHP, DiBP, and DnBP levels on the palm were larger than the back-of-hand, forehead, and forearm ($p < 0.05$), consistent with the palm being influenced by direct contact with room surfaces more than other skin locations. DEHP, DiBP, and DnBP levels on the back-of-hand were larger than on the forearm ($p < 0.05$). DiBP and DnBP levels on the forehead were larger than on the forearm ($p < 0.05$), while no significant difference was observed between forehead and forearm levels for DEHP.

Abstract Number	**P-1-24-17**
Presenter	Xiao Sun*
Exposure	organic compounds
Health domains	no health domain
Type of research	case-control study

New device of measuring volatile organic compounds emission from partial human skin

Abstract Our research group of Building Science in Tsinghua University has tested the cabin air quality of 109 air sorties in 2011. It was found that the VOCs concentration in summer significantly higher than other seasons. It is speculated that emission from human skin comprises major pollutant sources in crowded space. Through literature reviewing, human emanation in the field of indoor air quality (IAQ) is short of systematic theory and fundamental data. A device composed of an open-type Tedlar bag, air valves, flow meters and sampling tubes was invented to measure the VOCs emission from the hand. The samples of skin emission were concentrated by sorbent tubes, and analyzed by gas chromatography-mass spectrometry (GC / MS). A clever method was used in the measurement of skin area, using plastic membrane and coordinate paper. In the test, after the removal of the influence of irrelevant factors, a steady state sample of 17 VOCs was obtained, contained the highest concentration of decanal, MTBE and phenol. The emission rate of TVOC per area was 302.5 mg/h•m2, which amount to 329 m2 carpet and 13.6 m2 particle board. After using hand cream, a steady state sample of 60 VOCs was obtained, and the emission rate of TVOC per area increased to 9461 mg/h•m2. The operability, quantification and sensitivity of the device have been verified. Results have shown that the pollutant source of human skin emission has been long neglected in IAQ studies. Keyword:New device; Volatile organic compounds; Emission from partial human skin; Pollutant source; Indoor air quality

Abstract Number	**P-1-24-18**
Presenter	Heather Bolstad*, Dana Hollins, Christopher Ronk, Amina Foda, Rebecca Ward, Megan Jacobsen, Dennis Paustenbach
Exposure	organic compounds
Health domains	respiratory disease
Type of research	exposure measurement

Occupational Exposures Measured in a Food Flavoring Manufacturing Facility

Workers in flavoring manufacturing settings are exposed to a variety of chemicals; however, airborne concentrations of many of these chemicals have not been well characterized in the literature. We therefore sought to assess exposures to these flavoring chemicals to aid in future risk assessments. Area and personal air samples were collected between 1990 and 2012. Short-term (<30 min), task-based (30-239 min), and shift-based (≥ 240 min) samples were collected, and consecutively collected samples were combined where appropriate. 8-hour TWAs were also estimated. Among the chemicals analyzed were acetaldehyde, acetic acid, furfural, and propionaldehyde, all of which have occupational exposure limits in the U.S., as well as acetoin, benzaldehyde, butyric acid, and isobutyraldehyde. The total number of samples collected and analyzed, and the percent below the limits of detection (LODs), are as follows: acetaldehyde (n=129; 67.44%), acetic acid (n=69; 26.09%), furfural (n=104; 100%), propionaldehyde (n=106; 99.06%), isobutyraldehyde (n=103; 100%), butyric acid (n=111; 98.2%), benzaldehyde (n=114; 85.09%), and acetoin (n=177; 36.16%). In general, personal exposures to acetaldehyde, acetic acid, furfural, and propionaldehyde were higher during liquid compounding tasks when compared to packaging and laboratory tasks. Acetic acid was detected in shift-based samples collected during tasks in the liquid compounding, dry blend, packaging, and process flavors departments, whereas acetaldehyde was detected only during tasks in the liquid compounding area. Furfural and propionaldehyde were below the LOD in all personal shift-based samples. These data broaden our understanding of historical occupational exposures to food flavoring chemicals during flavoring production.

Abstract Number	**P-1-24-19**
Presenter	Elvira V. Bräuner, Ole Raaschou-Nielsen, Zorana Jovanovic Andersen, Jytte Halkjær, Anne Tjønneland, Steffen Loft, Sofie Marie Knudsen*
Exposure	organic compounds
Health domains	obesity
Type of research	health impact assessment

Polychlorinated biphenyl concentrations in adipose tissue and abdominal obesity in the elderly

Background: Obesity prevalence has more than doubled globally within the last 30 years. Obesity affects quality of life as well as impacts the risks and prognosis for a number of serious diseases. Established causes include a high calorie diet combined with a sedentary lifestyle and possibly the widespread cessation of smoking, but these do not fully explain the epidemic. Polychlorinated biphenyl congeners (PCBs) are endocrine-disrupting chemicals and evidence from animal experiments suggests an association with obesity development. Our knowledge of the effects of these compounds on weight gain in humans is limited. Aims: Our objective was to investigate the association between exposure to PCBs experienced by a general Danish population and development of obesity. Methods: We randomly selected 204 persons (113 obese and 91 overweight), aged ≥ 50 years, from a prospective Danish cohort of 57,053 persons and examined ten PCBs as potential determinants of abdominal obesity. Adipose tissue was collected upon enrolment and PCBs were quantified using gas chromatography-mass spectroscopy. Results: Median levels of the included PCBs were lower in women, except for PCB118 and all PCBs were positively associated with increased abdominal circumference, although this association was not significant. Conclusions: These data indicate a positive link between PCBs and obesity. More work is needed to fully elucidate the complex role of compounds such as PCBs in the present obesity epidemic.

Abstract Number	**P-1-24-20**
Presenter	Hsiu Ying Ku*, Shu-Li Wang, Pen Hua Su, Chien Jen Wang, Pao Chi Liao, Hsiao-Yen Chen
Exposure	others
Health domains	allergies
Type of research	cohort study

Prenatal and postnatal exposure to phthalate esters and asthma: an eight-year birth cohort study

Background: Previous studies have shown that exposure to phthalates in childhood is associated with the development of respiratory problems. However, prenatal phthalate exposure in humans has not been fully evaluated. Aims: Our aim was to assess in a birth cohort the impact of prenatal and postnatal exposure to phthalates on pediatric asthma. Methods: A total of 430 pregnant women were recruited and data collection was conducted at 2-3, 5-6 and 8-9 years old. Of the 256 children who had complete data at least one in the follow up. Urinary phthalate metabolites representing exposure to five phthalates (di[2-ethylhexyl] phthalate, butyl benzyl phthalate, di-n-butyl phthalate, diethyl phthalate and dimethyl phthalate) were measured byliquid chromatography-electrospray ionization-tandem mass spectrometry (LC–ESI-MS/MS). Assessment for allergic diseases was carried out by the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaires and serum total IgE levels at 8-9 years of age. Results: The 2-year-old boys in the upper quintile for urine DEHP metabolites at were positively associated with asthma at 8-9 years of age (MEHP: aOR: 6.06 ; 5oxo-MEHP: aOR=6.03, p-value <0.05). Similarly, boys at 5-6 years of age with higher 5OH-MEHP and MEP metabolite concentrations were later associated with asthma (aOR=5.85; aOR=8.74, p-value <0.05, respectively). Prenatal exposure to MBzP levels was associated with an approximately 6-times increase in wheezing (aOR=5.9, p-value: 0.022); their children had higher total IgE levels at 8-9 years of age (B=0.54, p-value<0.01). Conclusions: DEHP and DEP exposure may play a role in the development of asthma in boys.

Abstract Number	**P-1-24-21**
Presenter	Matthew Longnecker*, Efrain Terrazas-Medina, Mauricio Hernández-Avila
Exposure	persistent organic pollutants
Health domains	respiratory disease
Type of research	cohort study

Prenatal exposure to DDE and lower respiratory tract outcomes among boys from a highly exposed area of Mexico

Background. Low-level prenatal exposure to 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p'-DDE), the main breakdown product of the pesticide DDT, has been associated with recurrent lower respiratory tract infections in infants. Epidemiological data, however, are scarce. Aim. To assess whether prenatal exposure to p,p'-DDE is associated with a higher occurrence of lower respiratory tract infections during childhood among boys from Chiapas, a highly exposed area of Mexico. Methods. We analyzed data for 780 singleton boys whose prenatal exposure to p,p'-DDE was determined in maternal serum drawn at delivery (2002-2003). Information on respiratory outcomes (i.e., bronchiolitis and pneumonia) during childhood was reported by the mother and recorded by standardized interview during follow-up. The median age of the children during the follow-up period was 18.1 months (quartiles 14 and 22 months). Results. Median exposure to p,p'-DDE in this population was higher (2.7 µg/g lipid) than recent US levels (0.26 µg/g lipid). There were 0.18 episodes of bronchiolitis and/or pneumonia per child-year. After adjusting for maternal and child covariates, higher levels of p,p'-DDE were not associated with a higher rate of bronchiolitis and/or pneumonia during childhood. The adjusted rate ratio (RR) was 0.8 (95% CI, 0.4-1.4) for children in the highest exposure category (DDE >9.00 µg/g lipid) compared to those in the lowest category (DDE ≤3.00 µg/g lipid). Adjusted RRs were similar in the intermediate categories of DDE. Conclusions. An association of prenatal exposure to p,p'-DDE with lower respiratory tract infections during childhood was not supported in this population with relatively high levels of exposure.

Abstract Number	**P-1-24-22**
Presenter	Keane Tzong, Katrina Kezios, Piera Cirillio, Xinhua Liu, Katherine Keyes, Myrto Petreas, June-Soo Park, Ezra Susser, Barbara Cohn, Pam Factor-Litvak*
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Prenatal Exposure to Organochlorines and Adolescent Behavior

Background Fetal exposure to PCBs may result in adverse effects on child development. The pesticides DDT and chlordane share structural similarities with PCBs and are may be associated with similar outcomes. Potential effects of organochlorine compounds (OCs) on neurobehavioral effects during pre-adolescence have received little attention in the scientific literature. Aims We used adolescent self-report data from the Child Health and Development Studies prospective birth cohort to examine the association between prenatal exposure to OCs and behavioral disinhibition in adolescence. Methods Our data derive from a study of prenatal OCs, thyroid hormone levels and neurocognitive outcomes at ages 5, 9-11 and 15-17. We selected a sample of 600 offspring (300 boys and 300 girls). Serum OCs were measured in samples collected in the immediate post-partum period. PCBs were grouped according to degree of chlorination and by the method of Wolff et al. (1997). Behavioral disinhibition was assessed by a scale derived from a count of six child-report items at the age 15-18 interview. Regression models for count outcomes assessed the associations between each exposure and outcome, adjusting for potential confounders. Results Increases in prenatal OC exposure were not associated with increased scores on the scale of behavioral disinhibition. However, there was evidence for effect measure modification by child sex of the relationship between OC exposure and behavioral disinhibition. Scale score increased with exposure in males, and decreased with exposure in females. Conclusions Although increased prenatal PCB exposure is largely unassociated with increased levels of adolescent behavioral disinhibition, the exposure-outcome relationship is likely more complex than hypothesized. Evidence for effect measure modification of the relationship observed suggests that further investigation is required to fully elucidate the associations between PCB exposure and adolescent mental health.

Abstract Number	**P-1-24-23**
Presenter	Jia-Shian Shiu*, Chen Mei-Huei, Guo Yueliang Leon, Chen Pau-Chung
Exposure	organic compounds
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to perfluorinated chemicals and attention deficit/hyperactivity symptoms in children at 7 years of age

Background: Perfluorinated compounds (PFCs), persistent pollutions in environment, can cross the placental barrier and enter fetal circulation. Animal studies report exposure to the PFCs can give irreversible change in mouse brain and affect development. The association between perfluorooctanoic acid (PFOA) and perfluorooctylsulfonate (PFOS) exposure and ADHD symptoms is controversial in epidemiological studies. Aims: We evaluated the association between prenatal exposures to PFCs and ADHD symptoms. Methods: A total of 282 mother–newborn pairs from various medical facilities recruited from May 2004 to July 2005. Cord blood samples were collected at birth and analyzed for PFOA, PFOS, perfluorononanoic acid (PFNA), and perfluoroundecanoic acid (PFUA) by ultra-high performance liquid chromatography/tandem mass spectrometry. We assessed children behavioral health by using the Chinese version of the Swanson, Nolan, and Pelham, version IV scale (SNAP-IV), the Strengths and Difficulties Questionnaire (SDQ), and the Child Behavior Checklist (CBCL). Multiple linear and logistic regression models were used to examine the relationship between nature log transformed PFCs concentrations and scales. Results: The median concentrations of PFOA, PFOS, PFNA and PFUA were 0.8, 3.7, 1.3 and 2.9 ng/mL, respectively. After adjusting for potential confounding factors, we found increased PFNA concentrations were inversely associated with peer problems [odds ratio (OR) = 0.73; 95% confidence interval (CI), 0.57–0.92] and hyperactivity/impulsivity (OR=0.68; 95% CI, 0.54–0.88) and oppositional defiant disorder (OR = 0.71; 95% CI, 0.55–0.90). Increased PFUA concentrations also had inverse associations with peer problems (OR = 0.56; 95% CI, 0.42–0.74). Conclusions: Our findings suggest PFOA and PFOS are not associated with behavioral problems in childhood. However, PFNA and PFUA are negatively associated with some scales of SDQ and SNAP. Mechanistic studies are needed to elucidate the relationship between PFCs and ADHD.

Abstract Number	**P-1-24-24**
Presenter	Ikuko Kashino*, Emiko Okada, Seiko Sasaki, Chihiro Miyashita, Tamiko Ikeno, Atsuko Araki, Jun Yamamoto, Hideyuki Matsuura, Toru Matsumura, Akiko Tamakoshi, Reiko Kishi
Exposure	persistent organic pollutants
Health domains	other
Type of research	cohort study

Prenatal Exposure to 11 Perfluorinated Compounds (PFCs) and infant weight in the Hokkaido Study on Environmental and Children's Health

Background Several animal studies have demonstrated prenatal exposures to perfluorinated compounds (PFCs) decrease newborn birth weight. But in humans, not only low birth weight but also increase risk of obese is reported in proportion to maternal concentrations of PFCs. The effects of such PFCs on human infant growth remain unclear. Aims Our goal was to find blood concentrations of 11 PFCs and clarify their adverse effects of prenatal exposures on infant weight in a cohort study with large subjects. Methods Since January 2003, we have conducted a large-scale cohort in Hokkaido, Japan. We randomly selected 1,985 mother from 17,869 and obtained data from self-administered questionnaires and medical records, and measured concentrations of 11 PFCs in maternal plasma by UPLC/MS/MS. Multiple regression analysis was performed to examine the correlations between maternal blood concentrations of 11 PFCs and infant weight. Results After adjusting for possible confounding factors, perfluorononanoic acid (PFNA) levels negatively correlated with birth weight (per log-unit: partial regression coefficient β=-41.7 g, 95% CI, -77.9 to -5.6 g). After gender stratification, PFNA levels negatively correlated with male birth weight specifically (per log-unit: β=-59.3 g, 95% CI, -110.2 to -8.3 g). Perfluoroundecanoic acid (PFUnDA) and Perfluorotridecanoic acid (PFTrDA) levels negatively correlated with female birth weight (per log-unit: β=-42.0 g, 95% CI, -84.6 to 0.6 g and β=-44.9 g, 95% CI, -90.1 to 0.3 g, respectively). However, those effects of PFNA, PFUnDA, and PFTrDA were not observed any more at 18 month follow-up. Conclusions Our results suggest that prenatal exposures to longer PFCAs than that of PFOA tend to negatively correlate with infant birth weight. But those negative associations disappeared after 18 month follow-up.

Abstract Number	**P-1-24-25**
Presenter	Claire Philippat*, Jérémie Botton, Antonia M. Calafat, Xiaoyun Ye, Marie-Aline Charles, Rémy Slama
Exposure	biomarker
Health domains	obesity
Type of research	cohort study

Prenatal exposures to phenols and postnatal growth in boys during the three first years of life.

Background: Phenol perinatal exposures can affect weight at birth and during early life in experimental studies. Human studies suggested associations between prenatal exposure and birth outcomes but none described effects on weight and height in childhood. Objectives: We studied the association of maternal pregnancy exposure to phenols with male offspring postnatal growth. Methods:We measured 9 phenols in spot maternal urine collected during pregnancy. We predicted individual growth trajectories and velocities using weight and height measured the first 3 years of life (at least 4 measures per child), and also assessed abdominal circumference (AC), tricipital and subscapular skinfold thicknesses at 3 years. We studied associations between growth parameters and phenol concentrations using adjusted linear regression models. Results: Methylparaben concentration was positively associated with weight and height predicted at 6, 18 and 30 months (p-values 0.02–0.13) and with AC at 36 months (β = 4.2 mm; 95% confidence interval (CI), 0.7; 7.8). Association patterns for the other parabens were similar but weaker. After adjustment for child height, weight at 18 and 30 months respectively increased by 112 (95% CI, 21; 203) and 128 g (95% CI, 21; 236) for each interquartile range increase in bisphenol A (BPA) concentration. BPA was also positively associated with weight growth at 6 and 12 months (p-values < 0.08); the associations were stronger after height adjustment (p-values ≤ 0.04). Discussion:We only had spot urine sample to assess exposure and because of the short-half life of the studied phenols and the likely episodic nature of the exposures, findings may be affected by exposure misclassification. Nevertheless, our study lends support to a potential effect of prenatal exposure to some phenols on postnatal growth.

Abstract Number	**P-1-24-26**
Presenter	Roni Kobrosly*, Sarah Evans, Amir Miodovnik, Emily Barrett, Sally Thurston, Antonia M. Calafat, Shanna Swan
Exposure	others
Health domains	neurobehavioral effects
Type of research	cohort study

Sexually-Dimorphic Associations of Prenatal Phthalate Exposure and Neurobehavioral Development in 6-10 Year Olds

Background: Concern has been raised over the potential neurobehavioral effects of prenatal phthalate exposure but available data are inconsistent. Aims: To examine associations between prenatal urinary concentrations of phthalate metabolites and neurobehavioral outcomes among children. Methods: We analyzed data on 153 children, aged 6 to 10 years, born to participants in the Study for Future Families, a multicenter pregnancy cohort study. Maternal urinary phthalate metabolite levels were measured during late pregnancy by high performance liquid chromatography-tandem mass spectrometry. Children were evaluated with the Child Behavior Checklist. With a useful re-parameterization of a standard regression interaction model, we estimated sex-specific associations between neurobehavioral outcomes and phthalate metabolites levels, adjusting for the child's age, mother's education, family stress, and urinary creatinine. Results: Concentration of monoisobutyl phthalate was associated in boys (but not girls) with inattention (b=0.27 (95% CI=0.04, 0.50)), rule-breaking behavior (b=0.20 (95% CI=0.01, 0.38)), aggression (b=0.34 (95% CI=0.09, 0.59)), and conduct problems (b=0.39 (95% CI=0.20, 0.58)). Among boys, the (molar) sum of di-2-ethylhexyl phthalate metabolites was associated with somatic problems (b=0.15, 95% CI=(0.03, 0.28), while in girls, it was negatively associated with anxiety problems (b=-0.21, 95% CI=-0.38, -0.04). Higher monobenzyl phthalate concentration was associated in boys with more oppositional behavior (b=0.16 (95% CI=0.01, 0.32)) and conduct problems (b=0.21 (95% CI=0.06, 0.37)), but with reduced anxiety in girls (b=-0.20, 95% CI=-0.39, -0.01). Higher monoethyl phthalate concentration was associated with fewer affective problems in boys (b=-0.12, 95% CI=-0.24, -0.01). Conclusions: Our results suggest associations between exposure to certain phthalates in late pregnancy and behavioral problems in boys.

Abstract Number	**P-1-24-27**
Presenter	Christa Schröter-Kermani, André Conrad*
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

The German Environmental Specimen Bank: Human Exposure to Perfluoroalkyl Substances – Time Trends and Inter-individual Variation

Background and aimsTo assess the impact of mitigation measures on the human exposure to perfluoroalkyl substances (PFAS) and to elucidate gender and other inter-individual differences, PFAS levels in human blood plasma archived in the German Environmental Specimen Bank (ESB) have been analyzed. MethodsSince the 1980s, the ESB collects, stores, and analyzes human samples. Each year i. a. blood samples from 20-29 year-olds are acquired in four German cities. Physiological parameters are analyzed for substantiating the evaluation of the internal pollutant exposure. 258 plasma samples collected from 1982 to 2010 were analyzed for perfluorooctanesulfonate (PFOS), perfluorooctanoate (PFOA), and perfluorohexanesulfonate (PFHxS). ResultsAfter increasing from 1982-86, median PFOS concentrations leveled off at 20-24 ng/mL until the late 1990s. Since 2001 PFOS levels decreased to 4 ng/mL in 2010. Since the late 1980s, PFOA fluctuates between 4.8 and 6.3 ng/mL before starting to decrease in 2008. PFHxS levels increased continuously from 1 ng/mL in 1982 to 2 ng/mL in 2001. In 2010 the median PFHxS concentration was 0.9 ng/mL. PFAS levels tend to be higher in males. The overall median PFOA level in males (5.1 ng/mL) differs significantly from the median level in females (4.5 ng/mL). A similar result is observed for PFHxS (1.7 vs. 1.1 ng/mL). The median PFOS gender difference (15.5 vs. 12.4 ng/mL) is not significant (p=0.13). Bivariate analysis yielded significant correlations between PFAS levels and total protein in plasma (rank correlations: rPFOS=0.32, rPFOA=0.26, rPFHxS=0.22). No significant associations were observed between PFAS and BMI as well as triglycerides. ConclusionsESB data reflect the impact of regulatory measures on the human PFAS exposure. It allows for analyzing associations of exposure and physiological parameters that are vital for further elucidation of time-dependent inter-individual variation in PFAS exposure. AcknowledgmentsFunding by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is gratefully acknowledged.

Abstract Number	**P-1-24-28**
Presenter	Youssef Oulhote*, Bouchard Maryse
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Urinary metabolites of organophosphate and pyrethroid pesticides and behavioral problems in children from the general Canadian population

Background: Exposure to organophosphate insecticides has been associated with neurobehavioral deficits in children, although data on low levels of exposure experienced by the general population is sparse. Pyrethroids are another class of insecticides rapidly gaining popularity, and epidemiological evidence on their potential effects are lacking. Aims: Our goal was to examine the association of organophosphate and pyrethroid insecticides exposure with behavioral problems in Canadian children aged 6 to 11 years. Methods: We used data on 1081 children ages 6 to 11 years from the Canadian Health Measures Survey (2007-2009). We performed logistic regression to examine odds of behavioral problems, indicated by high scores on the Strengths and Difficulties Questionnaire, in relation with pyrethroid and organophosphate insecticides metabolites in urine, adjusting for covariates, and accounting for the sampling design. Results: Urinary concentrations of organophosphate metabolites were not significantly associated with behavioral problems. Higher concentration of the pyrethroid metabolite cis-DCCA was associated with behavioral problems (p=0.03), and there was a trend for trans-DCCA (p=0.12). For a 10-fold increase in cis-DCCA and trans-DCCA concentrations, the odds ratios (ORs) were 2.0 (CI95%, 1.1 to 3.6) and 1.6 (CI95%, 0.9 to 3.0), respectively. Another metabolite common to many pyrethroids, 3-PBA, was associated with conduct disorders among girls (OR, 2.2 [CI95% 1.0, 4.9]) but not boys (OR, 0.6 [CI95%, 0.3, 1.4]), although this association did not remain significant after accounting for the complex design (p=0.10). Conclusion: We did not observe the previously reported association between organophosphate insecticides and behavioral problems in children. However, our findings suggest that pyrethroids were associated with these problems. This is the first study to suggest this, and further research is needed on potential risks of exposure to pyrethroid insecticides for children's development.

Abstract Number	**P-1-24-29**
Presenter	Rhena Delport*, Johan Venter, Christiaan de Jager, Piet Becker, Riana Bornman
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	exposure measurement

Validity and reliability of second-to-fourth digit ratio determinations in adult males

Background Lower second-to-fourth digit (2D:4D) ratios in males purportedly reflect low pre-natal testosterone status. We postulated that the ratio would be affected with endocrine disruption due to maternal uptake of DDT. Aim The aim of the study was to identify the method of choice for the measurement of the digits. Method Measurements of digits were performed in 52 consecutive males – aged 18 and 34 years – who participated in an on-going cross-sectional study that assesses the effect of DDT uptake on male fertility. Method comparison was performed in 20 subjects by performing duplicate measurements of the 2nd and 4th right hand digits and calculating the ratios. A flatbed scanner with computer software was employed to measure from the tip of the digit to the proximal skin crease of the metacarpophalangeal joint (Method 1). With Method 2 and 3 direct measurements were performed using a vernier calliper to determine palmar and dorsal digit lengths, respectively excluding and including the metacarpal head. Intra- and inter-class correlation coefficients were determined, using AOV calculations, to assess reliability of measurement as well as agreement between methods. Percentage difference plots were used to assess whether a trend in over-and underestimation of ratios could be observed in all subjects using Method 1 as standard. Results Method 1 was identified as having the highest intra-class correlation coefficient (0.991) followed by the palmar (0.958) and the ventral (0.888) measurements. An inter-class correlation coefficient of 0.632 was observed. Ventral measurements displayed under-estimation (up to 8%) with lower ratios and over-estimation (up to 6%) with higher ratios. Conclusion The method of choice for calculation of the 2D:4D ratio appears to be a palmar scan using specific software for measurement. The measurement methods should not be used interchangeably.

Abstract Number	**P-1-24-30**
Presenter	Chia-Fang Wu, Po-Chin Huang*
Exposure	organic compounds
Health domains	other
Type of research	cohort study

Relationship of urinary concentrations of 9 phthalate metabolites with serum thyroid hormones in pregnant women and their newborns in Taiwan

Background: A growing number of animal and epidemiological studies have indicated that environmental chemicals can interrupt the regulation of thyroid function. However, only a few studies were reported the effects of phthalates exposure on thyroid function in pregnant women and their newborns. Objective:The present study was to investigate the association between maternal phthalate exposures and their thyroid hormones, and cord thyroid hormones in their newborns from the general population in Taiwan. Methods: A total of 150 maternal and infant pair was recruited from E-Da hospital in the southwestern Taiwan, from 2009 to 2010. Pregnant women were interviewed by a standardized questionnaire, and we also collected their urine and blood samples at third trimester and cord blood samples at delivery. Nine phthalate metabolites (MEHP, 5OH-MEHP, 5oxo-MEHP, MiBP, MnBP, MBzP, MEP, MMP, and MiNP) in urine samples were determined by liquid chromatography/ electrospray tandem mass spectrometry (LC-ESI-MS/MS). Serum thyroid hormones of pregnant women and cord thyroid hormones (TSH, Free T4, T3 and T4) of newborns were measured by enzyme immunoassay (EIA). Results: Mean (±SD) age and pre-pregnant BMI of pregnant women were 29.4±4.9 years old and 22.0±3.5, respectively. Less than 3% of them had smoking and drinking habit. Mean gestational age of newborns were 38.5±1.1 weeks. For the maternal urinary phthalate metabolites, the three most higher concentration were MnBP (median, 37.81 mg/g Cr), MEP (34.51 mg/g Cr) and 5OH-MEHP (21.73 mg/g Cr). Significant negative correlation were found between TSH levels in cord serum and maternal urinary 5oxo-MEHP ($r=-0.221$, $p<0.01$), 5OH-MEHP ($r=-0.263$, $p<0.01$) and MBzP ($r=-0.263$, $p<0.01$). After adjusted for age, pre-pregnant BMI, gestational age, maternal TSH and other phthalate metabolites, maternal urinary MBzP and MEP concentrations showed a negative association with TSH levels in cord serum ($\beta=-3.04$, $p=0.003$ for MBzP; $\beta=-2.01$, $p=0.046$ for MEP). Conclusion: Maternal exposure to butyl benzyl phthalate (BBP) and diethyl phthalate (DEP) may affect thyroid activity of their newborns, however, how BBP and DEP affects newborns' thyroid function is unclear. Further studies are need to elucidate this mechanism and to investigate whether any other factors related to BBP and DEP exposure alter the newborns thyroid function.

Abstract Number	**P-1-25-01**
Presenter	Ying-Ying Meng*, Susan Babey, Melissa Pickett, Joelle Wolstein
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cross-sectional study

Air Pollution Exposure and Type-2 Diabetes Prevalence and Severity

The number of people in the U.S. with diabetes has reached epidemic proportions-- increasing from 5.6 million affected in 1980 to 20.9 million in 2010. Development and exacerbation of type-2 diabetes has been linked to a combination of genetic, behavioral and environmental factors. Recent studies suggest increased air pollution exposure may play a role in insulin resistance and type-2 diabetes development. This study investigates whether prevalence and severity of type-2 diabetes are related to increased criteria pollutant exposures. Using 2005 California Health Interview Survey (CHIS) data and Geographic Information System software, we linked adults' residential addresses to government monitors for NO2, O3, PM10 and PM2.5. We estimated individual 3-year average exposures. We used logistic regression analyses to evaluate the relationship between pollutant exposures and increased odds of receiving a type-2 diabetes diagnosis, as well as increased odds of medication use (pills, insulin, or both) to treat type-2 diabetes, controlling for age, sex, race, and poverty level. Among CHIS 2005 respondents, increases in PM10 and NO2 were associated with 3% and 8% respective increases in odds of receiving a type-2 diabetes diagnosis. Among adults with type-2 diabetes, increases in O3, PM10, and PM2.5 were associated with 40%, 56%, and 50% respective increases in odds of taking any medication; 33%, 31%, and 41% respective increases in odds of taking pills only; 43%, 53%, and 46% respective increases in odds of taking insulin only; and 70%, 60%, and 88% respective increases in odds of taking insulin and pills. These findings add to growing evidence that pollutant exposures may be linked to type-2 diabetes prevalence and severity. The findings highlight the importance of intervening against modifiable and pervasive environmental factors, such as air pollution, contributing to type-2 diabetes.

Abstract Number	**P-1-25-02**
Presenter	Beatriz Valera*, Eric Dewailly, Renee Dallaire, Pierre Ayotte, Eladhji Anassour-Laouan-Sidi, Paul Poirier
Exposure	persistent organic pollutants
Health domains	diabetes
Type of research	cross-sectional study

Associations between persistent organic pollutants and insulin resistance in a highly exposed population from Arctic Quebec (Canada)

Background: Experimental and epidemiological evidence suggest that exposure to persistent organic pollutants (POPs) could increase the risk of diabetes. Thus, testing this hypothesis is important in Arctic populations, which are highly exposed to POPs mainly through marine mammals' consumption. Aim: To examine the associations between POPs and insulin resistance among Inuit from Nunavik. Methods: Twenty polychlorinated biphenyls (PCBs) and 6 organochlorine (OC) pesticides were measured in plasma samples of 703 adults (≥ 18 years), who participated in the health survey «Qanuippitaa?». Fasting plasma glucose (FPG) and fasting plasma insulin (FPI) were also determined. The associations between POPs and FPG and FPI were studied using analysis of covariance (ANCOVA). We compared means of FPG and FPI across quintiles of POPs after excluding individuals with diagnosed diabetes. Models were adjusted for age, sex, waist circumference, total lipids, smoking and physical activity. Results: FPG increased across quintiles of total dioxin-like PCBs with significant differences between Q3 and Q5 (4.37 vs. 4.53 mmol/L, p= 0.046) and between Q4 and Q5 (4.39 vs. 4.53 mmol/L, p= 0.027). A similar pattern was observed for FPI. Moreover, FPG and FPI were significantly higher in the 5th quintile of total non-dioxin-like PCBs compared to lower quintiles. In contrast, pesticides such as oxychlordane and p',p-DDE were only associated to increasing FPI (p linear trend=0.03 in both models). Conclusions: PCBs were associated with increasing FPG and FPI while pesticides were mainly related to increasing FPI, thus providing evidence that POPs could be associated with insulin resistance.

Abstract Number	**P-1-25-04**
Presenter	Gudrun Weinmayr*, Frauke Hennig, Kateryna Fuks, Susanne Moebus, Michael Nonnemacher, Hermann Jakobs, Stefan Möhlenkamp, Raimund Erbel, Karl-Heinz Jöckel, Barbara Hoffmann, on behalf of the Heinz Nixdorf Recall Investigator Group
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cohort study

Differential association of industry and traffic related particulate matter with the incidence of type 2 diabetes in the Ruhr area, Germany

Background: Studies investigating the link between long term exposure to air pollution and incidence of type 2 diabetes mellitus (T2DM) are still scarce and results for particulate matter (PM) are conflicting. None of the previous studies has addressed source-specific contributions of PM. Aims: To investigate the association between the incidence of T2DM and long term exposure to PM from all sources (total PM) and PM attributable to local traffic and industry. Methods: We followed prospectively 3642 individuals without diabetes (based on self-report and random glucose measurements) at baseline (2000-2003) from the Heinz Nixdorf Recall study in Germany. The follow-up examination took place from 2006-2008, mean follow-up time was 5.1 years and 336 incident cases developed within this period. Mean annual exposures to PM10 and PM2.5 in 2001-2002 were estimated with a chemistry transport model (EURAD, 1 km2 resolution), using simulations that eliminated sources to estimate PM attributable to local traffic and local industry. Effect estimates for an increase of 1µg/m3 in total and source-specific PM were obtained with Poisson regression adjusting for sex, age, BMI, lifestyle factors, individual and area socioeconomic status and city. Results: We found an association for total PM10, with a RR of 1.05 (95%-CI: 1.01;1.10). The result for PM2.5 was similar but not statistically significant (RR=1.04; 95%-CI: 0.96;1.12). A markedly stronger effect was found for PM related to local traffic with RRs of 1.39 (95%-CI: 1.00;1.93) for PM10 and 1.39 (95%-CI: 1.00;1.95) for PM2.5. For PM related to local industry emissions, we observed RRs of 1.02 (95%-CI: 0.93;1.10) for PM10 and 1.03 (95%-CI: 0.96;1.17) for PM2.5. Conclusion: Total PM10 and traffic-related PM are associated with T2DM incidence. Effect estimates per µg/m3 were markedly higher for traffic-related PM compared to total PM.

Abstract Number	**P-1-25-05**
Presenter	Ling-I Hsu*, Hung-Yi Chiou, Chien-Jen Chen
Exposure	arsenic
Health domains	diabetes
Type of research	cohort study

Dose response relationship between arsenic exposure from drinking water and Diabetes mellitus in high and low-to-moderate exposed area in Taiwan

Background: Epidemiological studies have shown that high level arsenic exposure is associated with type 2 diabetes (T2D). The association between low-to-moderate arsenic exposure and T2D remains inconclusive. The aim of this study was to examine the association of chronic arsenic exposure from drinking water and T2D across low to high levels in two exposed areas in Taiwan by long-term perspective study. Methods:The southwestern (SW) cohort was recruited from blackfoot disease endemic townships with high arsenic levels in their well water, while the northeastern (NE) cohort was recruited from four townships in the Lanyang Basin with low-to-moderate arsenic level. The status of diabetes for study subjects was ascertained through linkage with the computerized Taiwan National Health Insurance (NHI) database from 1998 to 2009.Cox regression analysis was used to determine the hazard ratios (HRs) and 95% confidence intervals (CIs) for developing newly-diagnosed T2D. Results: A total of 489 and 1,310 newly diagnosed diabetes patients, corresponding to 33.7 and 21.7 per 1000 person-years, were observed in SW and NE cohort, respectively. Significant dose-response relationship between arsenic and T2D was observed in SW cohort. The adjusted hazard ratio were 1.00 (referent), 1.16 (0.85-1.59), 1.31 (0.98-1.76) and 1.88 (1.39-2.53) in relation to cumulative arsenic exposure of 0, 0.1-9.9, 10.0-19.9 and≧20.0 mg/L*years, respectively. No significant association was observed in NE cohort. However, among NE cohort with BMI <20, people having consumed water with arsenic >10µg/L had 74%~145% increased T2D risk when compared to those consuming water with arsenic ≦10µg/L. Conclusions: Dose-response relationship between arsenic exposure from drinking water and T2D was consistently observed among highly-exposed study cohort. For people with low-to-moderate arsenic exposure, the association was more confined to those with lower BMI.

Abstract Number	**P-1-25-06**
Presenter	Maddalena D Addario*, Paolo Villari, Angelo Giuseppe Solimini
Exposure	ambient air pollution
Health domains	diabetes
Type of research	others

Ecological association between diabetes hospital discharges and air pollution in Italian provinces

Background. It has been hypothesized that exposure to traffic-related air pollution might be an environmental risk factor for type 2 diabetes. Aims. The aim of our study was to evaluate the association between air pollution exposure and diabetes hospital discharge in Italian provinces, using current national health statistics and air pollution monitoring data aggregated at the province and region levels.Methods. Standardized hospital discharge with diabetes as primary diagnosis for patients aged 45 or older for the period 2006-2010 was studied with a multilevel mixed model including province and region as random factors and year and the yearly frequency of exceedance of limit values for PM10 as fixed factors. Level 2 covariates included regional prevalence of diabetes, percentage of obese, of heavy smokers and gross national product per individual.Results. In the studied years, the average standardized hospital discharge rates for diabetes (x 10,000 people), were 25.80 (±1.01) for females and 33.98 (±1.21) for males and showed a marked geographical pattern being higher in the South (47.99 (±2.73) and 59.24 (±3.46) respectively in females and males) and lower in the North (15.64 (±0.68) and 23.51 (±0.97) respectively in females and males) of Italy. Hospital discharge decreases with years for both, males (b= -3.95; p≤0.001) and females (b= -4.35; p≤0.001). The year x exceedance of limit values interaction term was significant (p≤0.001) showing a decrease of discharges with higher frequency of exceedances (b= -0.02; p≤0.001), after adjusting for all other covariates.Conclusions. Thanks to the increased appropriateness of hospital admissions, in Italy the standardized hospital discharge rates for diabetes has decreased during the last 10 years from 26.6 to 15.6 x 10,000 people. Yearly frequency of PM10 limit exceedance showed a reversed relationships with hospital discharges with diabetes as primary diagnosis.

Abstract Number	**P-1-25-07**
Presenter	Yoon-Hyeong Choi*, Jin Hee Kim, Yun Chul Hong
Exposure	organic compounds
Health domains	other
Type of research	others

Environmental Exposure to Polycyclic Aromatic Hydrocarbons and Benzene and Insulin Resistance in Elderly Adults

Background: Urban air pollution is an important environmental health risk factor and has been suggested to be associated with an increase in insulin resistance in elderly adults. Despite extensive investigation, the underlying mechanisms of air pollution-related health effects are not completely understood. Attention has recently focused on chemical components of air pollution, such as polycyclic aromatic hydrocarbons (PAHs) and benzene. Aims: We examined the associations between urinary markers for PAHs and benzene exposure and insulin resistance (IR) in the elderly, controlling for major risk factors contributing to the increase in IR. Methods: We analyzed data obtained from 502 adults ≥60 years of age between 2008 and 2010 from a community-based panel of elderly subjects in Seoul, Korea. Linear mixed effect models were fit to evaluate the associations of either urinary 1-hydroxypyrene (1-OHP) or trans, trans-muconic acid (t,t-MA) concentrations with IR markers of fasting glucose and insulin and homeostatic model assessment index (HOMA), respectively, controlling for potential confounders. Results: After adjusting for sociodemographic, environmental exposure, and metabolic syndrome-related factors, the highest (vs. lowest) quartiles of 1-OHP and t,t-MA were associated with 0.51 (95% CI: 0.11-0.90) and 0.63 (95% CI: 0.20-1.06) increases in HOMA score, respectively (p-trends < 0.05). When stratified by sex and factors related to metabolic syndrome, stronger dose-dependent trends of 1-OHP and t,t-MA with HOMA were observed, particularly in female and subjects with hypertension, diabetes, and BMI≥25kg/m2. Conclusions: Our results suggest that low-level exposure to PAH and benzene may be important risk factors for increased insulin resistance in urban elderly adults.

Abstract Number	**P-1-25-08**
Presenter	Chien-Yuan Huang*, Guo How-Ran
Exposure	organic compounds
Health domains	diabetes
Type of research	cross-sectional study

Higher prevalence of Diabetes Mellitus related to higher serum dioxin level in an endemic area of dioxin exposure in southern Taiwan

Background: Diabetes Mellitus (DM) has been found to be related to dioxin in certain populations. Insulin resistant was also found to be correlated to dioxin levels in an area of Tainan, Taiwan where residents were exposed to dioxin released from a factory from 1965 to 1979. Aims: We conducted a study to assess the association between DM and dioxin exposure and to identify risk factors of DM among the residents of the endemic area. Methods: We recruited residents with high levels of dioxin, defined as ≥ 64 pg WHO98-TEQDF/g lipid and performed health examination between October 1, 2008 and December 31, 2009. DM was defined by a fasting serum glucose level > 126 mg/dl or an existing diagnosis of DM. The results were compared to a group of residents whose blood dioxin levels were below 64 pg WHO98-TEQDF/g lipid. Results: Of the 2899 participants, 316 were diagnosed as cases of DM. We observed positive associations between DM and dioxin exposure, age, body mass index (BMI), total cholesterol, triglyceride (TG), low density cholesterol, and high density cholesterol (HDL) (all with p <0.05). After adjusting for other factors, we found high dioxin exposure (adjusted odds ratio [AOR] associated with 20-64 pg WHO98-TEQDF/g lipid =1.89, 95% confidence interval [CI]: 1.32-2.71; AOR for >64 pg WHO98-TEQDF/g lipid =2.03, 95% C.I.:1.28-3.21), age (AOR for 30-39 years old =6.38, 95% CI: 1.92-21.18; AOR for 40-49 years old =6.93, 95% CI: 2.08-23.02; AOR for 50-59 years old =16.49, 95% CI: 4.99-54.54; AOR for 60-69 years old =22.8, 95% CI: 6.78-76.63; AOR for ≥ 70 years old =22.45, 95% CI: 6.74-74.78), high BMI (AOR for BMI 24-27 =1.89, 95% CI: 1.35-2.64; AOR for BMI 27-30 =1.74, 95% CI: 1.19-2.54; AOR for BMI >30 =2.49, 95% CI: 1.64-3.78), high TG (AOR =2.34, 95% CI: 1.76-3.11), and high HDL (AOR =1.35, 95% CI: 1.02-1.78) were independent predictors of DM. Conclusion: DM is correlated with high dioxin levels in the endemic area. It is also related to the age, BMI, TG, and HDL.

Abstract Number	**P-1-25-09**
Presenter	Harish C. Phuleria*, V Chandrasekaran, Soumya Swaminathan, Nicole Probst-Hensch
Exposure	household air pollution
Health domains	diabetes
Type of research	cross-sectional study

IMPACT OF HOUSEHOLD COOKING FUELS ON GENDER-SPECIFIC ADULT TUBERCULOSIS AND DIABETES IN INDIA: A CROSS-SECTIONAL SURVEY

Background:Indoor air pollution due to solid cooking fuels has been widely reported to be an important risk factor for tuberculosis (TB). A few recent studies implicate its association with diabetes as well. Aims: We aim to investigate the effect of household cooking fuel and other environmental factors on TB and diabetes in Indian population. Additional aim is to explore the gender-specific differences in risk factors of the two diseases. Methods: The data is extracted from the most recent National Family Health Survey (NFHS-3), a nationally representative demographic and health survey of Indian households.Detailed structured interview was conducted covering a total of 124,385 women, aged 15-49 and 74,369 men, aged 15-54 during 2005-2006. Information was collected on TB and diabetes, household characteristics including cooking fuels, socio-economic, life-style and other factors. Multivariate logistic regression models are built to assess the impact of household cooking fuels on TB and diabetes. The cooking fuels are re-categorized as clean (as reference), kerosene and solid biomass fuels. Results: Both kerosene and solid biomass cooking fuels were associated with increased risk of TB in women (odds ratios 2.27 (95% CI 1.43, 3.62) and 2.34 (1.86, 2.94) respectively). The risk decreased for kerosene (OR 1.51 (0.93, 2.49)) but disappeared for solid cooking fuels (OR 1.19 (0.86, 1.65)) after controlling for age, BMI, socio-economic, diet and lifestyle factors. In contrast, diabetes was negatively associated with solid cooking fuels (OR 0.44 (0.39, 0.49)) but not with kerosene (OR 1.08 (0.85, 1.36)). After adjusting for the potential confounders the risk increased slightly for kerosene (OR 1.23 (0.95, 1.59)) and solid cooking fuels (OR 0.90 (0.75, 1.07)) but no longer remain statistically significant. Separate analysis in men is currently underway. Conclusions: Our first results show kerosene use is associated with increased risk of TB and diabetes in Indian women.

Abstract Number	**P-1-25-10**
Presenter	Jose Guillermo Alonso Arvizu*, Maria Alejandra Pila Villalobos, Ruth Araceli De Celis Carrillo
Exposure	arsenic
Health domains	diabetes
Type of research	others

Incidence of type 2 diabetes mellitus in a population chronically exposed to arsenic.

Background: Diabetes mellitus (DM) is a chronic disease with an important social and health impact by high frequency, and high mortality due to complications involved. Mexico has a prevalence of 14% remain Jalisco state that ranks third nationally in type 2 diabetes mellitus (DM2), with 2.953 deaths for 2011. DM2 recently been linked to arsenic (As) exposure since this metalloid plays an etiological role in the disease. Objective: To evaluate the available information to determine the relationship between arsenic and diabetes mellitus 2 in a population chronically exposed. Methods: We analyzed the DM database of the Mexican Social Security Institute (IMSS) in the municipality of El Salto and Juanacatlán, Jalisco, and inventories of water discharges. Results: There were a total of 3.846 patients with diabetes mellitus, of which, 796 were for type 1 diabetes mellitus (DM 1) and 3.047 to DM 2. Of the group of patients with DM 2, 1.765, higher incidence was observed in women and a significant increase in men and for every man if there are two cases of women. Pollution indices indicate that 36.5% are chemical-pharmaceutical industry, 15% food and beverage industry and textiles to 12.3%, which discharged directly to waters with pollutants As. Conclusions: It is necessary to further studies to determine the influence of the As in the development of T2DM in this area of environmental fragility.

Abstract Number	**P-1-25-11**
Presenter	Hyemi Lee*, Hye-Yin Park, Youn-Hee Lim, Yoon-Hyeong Choi, Jin Hee Kim, Yun Chul Hong
Exposure	biomarker
Health domains	diabetes
Type of research	others

Insulin Resistance is Associated with Urinary Formaldehyde Levels in the Elderly

Background Endogenous formaldehyde(FA) was reported to be involved in age-related disease such as cardiovascular disease. Aims The aim of this study was to investigate the relation of urinary FA with insulin resistance in the elderly. Methods We used data from the Korean Elderly Environment Panel (KEEP) Study. It recruited 560 Koreans 60 yrs old or more in Seoul from Aug. 2008 to Aug. 2010. Urinary FA, glucose, insulin, homeostatic model assessment-insulin resistance (HOMA-IR), malondialdehyde(MDA) were measured repeatedly up to 3 times. Results Urinary FA levels were significantly associated with HOMA-IR after adjustment for confounders (β: 0.5394, $p < 0.0001$). They were also significantly associated with insulin (β: 1.4562, $p < 0.0001$), and MDA (β: 0.2568, $p < 0.0001$). Urinary FA levels upper than median had a 1.51-fold (95 % CI: 1.02-2.23) increased risk of insulin resistance (HOMA ≥ 2.5) compared to those lower than median. Conclusions The findings of this study suggest that endogenous FA increases insulin resistance in the elderly. Oxidative stress contributed by FA might play a role in a mechanism of insulin resistance.

Abstract Number	**P-1-25-12**
Presenter	Jennifer Roberts*, Jameson Voss, Brandon Knight
Exposure	ambient air pollution
Health domains	physical activity
Type of research	cross-sectional study

Physical inactivity, ambient air pollution and obesity in the United States

Background: Physical inactivity, ambient air pollution and obesity are modifiable risk factors for non-communicable diseases, with the former accounting for 10% of premature deaths worldwide. Although community level interventions may target each simultaneously, research on the relationship between these risk factors is lacking. Aims: After comparing spatial interpolation methods to determine the best predictor for particulate matter ((PM2.5); (PM10)) and ozone (O3) exposures throughout the U.S., we evaluated the cross-sectional association of ambient air pollution with physical inactivity among adults. Methods: Using Behavioral Risk Factor Surveillance System 2011 data, we assessed physical inactivity and using the U.S. Environmental Protection Agency's Air Quality System data we modeled and compared county-level air pollution exposure estimates using two interpolation methods: Inverse Distance Weighting (IDW) and Empirical Bayesian Kriging (EBK). We evaluated whether those exposed to higher levels of air pollution were less active using logistic regression, adjusted for demographic and behavioral risk factors and stratified by body weight category. Results: With EBK air pollution values, we estimated a 4-5% increased odds of physical inactivity per ug/m3 increase of (PM2.5) in a fully adjusted model across all weight strata (p-value<0.0001). We identified dose-response relationships between (PM2.5) exposure and the odds of physical inactivity. Additionally, the normal weight stratum was found to have the highest odds ratios by (PM2.5) exposure class followed by the overweight and then obese strata. Conclusions: In a nationally representative, cross-sectional sample, increased community level air pollution is associated with reduced physical activity particularly among the normal weight. Although our design precludes a causal inference, these results provide additional evidence that air pollution should be investigated as an environmental determinant of inactivity.

Abstract Number	**P-1-25-13**
Presenter	Patricia Coogan*, Laura White, Michael Jerrett, Bernardo S. Beckerman, Jeffrey Yu, Robert Brook, Richard T. Burnett, Edmund Seto, Lynn Rosenberg
Exposure	ambient air pollution
Health domains	diabetes
Type of research	cohort study

PM2.5 exposure and incident diabetes and hypertension: Preliminary results from the Black Women's Health Study

Background. Laboratory evidence suggests that fine particulate matter PM2.5 may contribute to the genesis of chronic conditions like diabetes and hypertension. Although air pollution has been associated with the prevalence of these conditions, the few epidemiologic data on its relation to incident diabetes and hypertension have been inconsistent. Aims. We assessed the association of ambient PM2.5 and incident type 2 diabetes and hypertension in the Black Women's Health Study (BWHS), a follow-up study of African American women. Methods. BWHS participants reported incident diabetes and hypertension on biennial questionnaires from 1995-2011. We estimated long-term average PM2.5 levels at participant addresses from 1998-2009 in 56 cities across the U.S. using a hybrid model combining land use regression and Bayesian Maximum Entropy kriging. We used Cox regression models to estimate city-specific hazard ratios (HR) associated with a 1.75 µg/m3 increase in PM2.5, the mean interquartile range in the major cities. City-specific HRs were then pooled in a summary estimate. Results. Of 33,621 women free of diabetes in 1995, 4078 developed diabetes over 16 years of follow-up; of 32,638 hypertension-free women in 1995, 9588 developed hypertension. The age-adjusted HR for diabetes was 1.09 (95% CI 1.03-1.15). After control for age, body mass index, and neighborhood socioeconomic status, it was 1.02 (95% CI 0.96-1.08). For hypertension, the respective HRs were 1.03 (95% CI 1.00-1.07) and 0.98 (95% CI 0.95-1.02). Conclusions. These results do not provide evidence of an association between PM2.5 and incident diabetes or hypertension in black women. Future work will assess the effects of traffic-related air pollutants, which were previously associated with incident diabetes in BWHS participants living in Los Angeles (Coogan et al., Circulation 2012;125:767-772).

Abstract Number	**P-1-25-14**
Presenter	Riikka Airaksinen*, Panu Rantakokko, Johan G Eriksson, Clive Osmond, Eero Kajantie, Hannu Kiviranta
Exposure	food
Health domains	diabetes
Type of research	cross-sectional study

PRESENCE OF THE ALA ALLELE IN THE PPAR-GAMMA GENE IS NOT PROTECTIVE AGAINST RISK OF IMPAIRED GLUCOSE METABOLISM ASSOCIATED WITH POP EXPOSURE

BACKGROUND Exposure to persistent organic pollutants (POPs) is associated with type 2 diabetes. Presence of the Ala allele in the peroxisome proliferator-activated receptor-gamma (PPARG) gene has been shown to be protective against type 2 diabetes, due to decreased accumulation of adipose mass. AIMS The objective is to study whether the presence of the Ala allele is protective against increased risk of type 2 diabetes associated with POP exposure among Finnish elderly subjects.METHODS The original birth cohort consists of 8,760 people born as singletons at the Helsinki University Central Hospital during 1934–1944. From the original study cohort, 2,003 men and women were selected at random to attend a clinical examination in 2003. The examination included a standard 2-h 75–g oral glucose tolerance test (0, 30 and 120 min), and blood sampling. WHO 2009 diagnostic criteria for type 2 diabetes and glucose regulation were used. Regression analyses were adjusted for age, sex, and waist circumference. The serum concentrations of oxychlordane, trans-nonachlor, p,p'-DDE, and PCB 153 were transformed into normalized ranks, summed, and categorized using 25th and 75th percentiles as cutoff points.RESULTS The frequency of Ala allele was 18% and the median serum concentrations of oxychlordane, trans-nonachlor, p,p'-DDE, and PCB 153 were 11, 28, 470, and 287 pg/g of lipid, respectively. High POP exposure was positively associated with type 2 diabetes, among both carriers with (OR=2.8, p=0.003) and without (OR=1.7, p=0.025) the Ala allele. However, POP exposure was associated with impaired fasting glucose among carriers (OR=2.8, p=0.002), whereas among non-carriers the association was inverse but non-significant (OR=0.38, p=0.14). POP exposure was not associated with glucose secretion, but significantly decreased insulin secretion during OGTT regardless of PPARG genotype.CONCLUSIONS Association between POPs and type 2 diabetes and early signs of impaired glucose metabolism is irrespective of PPARG polymorphism.

Abstract Number	**P-1-25-15**
Presenter	Fung-Chang Sung*, Chung-Fen Lin, Min-Hei Su, Wen-Chao Ho, Jin-Hua Chen
Exposure	persistent organic pollutants
Health domains	diabetes
Type of research	meta-analysis

Systemic Study on Association between Dioxin and Risk of Diabetes

Background. Fears on associations between dioxin exposures and risks of diabetes mellitus (DM), carcinogenesis and other disorders are common because of the wide environmental distribution of this highly toxic chemical. Study results on association with the DM risk remain debatable because studies on the relationship are based on local episodes with cross sectional designs. Aims. For this systemic review, we search for case-control studies published in the recent decade that reported the association between dioxin exposures and DM risks. Methods. We summarized results across 6 studies of case-control designs by meta-analysis. Odds ratios (OR) of DM for the highest dioxin exposure levels compared with the lowest levels were summarized. Other covariates with potential association with the risk of DM were also summarized to evaluate the contribution to the DM risk. Results. The exposure to specific dioxin spices at the highest serum levels revealed odds ratios (OR) of DM ranged from 1.18 (95% confidence interval (CI) 0.63-2.22) to 1.89 (95% CI 1.22-2.91) for those with HbAlc of 5.9-6.4%, or to 2.01 (95% CI 1.35-2.98) for those with HbAlc of 5.9% and above. A study in Japan found an adjusted odds ratio of 10.0 (95% CI 2.9-66.0) for those with serum PCDD/F of >15.05 pg/g lipid, compared with that of < 6.075 pg/g lipid. However, studies also showed that the DM risk increased as the increase of age, body mass index (BMI) or waist measure. Population with dioxin exposure from agriculture pesticides and BMI of 32 kg/m2 or higher had an OR of 9.77 (95% CI = 7.69-12.4) for DM. Conclusion. Whether the association between humans exposure to dioxin and DM risk is a secondary association with other factors such as BMI needs further studies using prospective designs. Keywords: diabetes mellitus, dioxin, case-control study, meta-analysis.

Abstract Number	**P-1-25-16**
Presenter	Morteza Khafaie*, Behzad Khafaie, Sundeep S. Salvi, Ajay Ojha, Chittaranjan S. Yajnik
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

The impact of air pollution on respiratory health among diabetes and non-diabetes subject in Pune, India

Background: Diabetes may be more vulnerable to ambient air pollutants than healthy individuals. But, the risk factors that lead to susceptibility to air pollution in these diseases have not yet been identified. Aims: of this study was to examine the effect of air pollution on the pulmonary function test (PFT) and symptom. Methods: study recruited 400 type 2 diabetes and 465 healthy subjects who undergo into measurement of FVC and FEV1. Per cent predicted FEV1 and FVC (%FEV1 and %FVC respectively) for each subject were calculated. Particulate matter (PM10) concentrations at residence place of subjects were estimated using AERMOD dispersion model. The association between PM10 and %FEV1 and %FVC were investigated using linear regression models controlling for potential confounders, also effect of PM10 on chronic respiratory symptom was explored using logistic regression model. Result: There were no significant difference between % predicted value of PFT among diabetes and non-diabetes subject, and age group (P<0.05). Presence of diabetes was associated with odd of presences of current wheezing, allergy symptom, chest tightness, FEV1/FVC<70%, and physical diagnosed asthma and COPD. The adjusted odds of having dyspnea was 1.25 fold (95% C.I, 1.04- 1.50) greater in those exposed to 1SD (=61.28) µg/m3higher PM10 concentration. Higher exposure to PM10 concentration was significantly associated with lower %FVC. The size of effect on population mean %FVC was about 1.57% (0.20% to 2.94%) for 1SD µg/m3 increase in PM10 concentration. However, the effects were most marked in overweight, smoking, and older adult. Conclusions: PM10 exposure is associated with lower lung function independents of diabetes status. This study suggests that decline in exposure may significantly reduce disease manifest as dyspnea and impaired lung function. We conduct that higher BMI, smoking, and older age, are modifier of this association.

Abstract Number	**P-1-25-17**
Presenter	Pi-I Li*, Chih-Ching Chang
Exposure	no exposure
Health domains	diabetes
Type of research	cohort study

The impact of diabetic HbA1c exam on the occurrence of chronic kidney disease in type 2 diabetic patients

Background: Diabetes mellitus is a major public health problem in Taiwan. In association with increasing diabetes prevalence, this will result in increasing the associated consequences of many complications of diabetes. And its complication significantly contributes to the morbidity and mortality. Adherence to proposing HbA1c test guideline can be effective in slowing disease progression and risk reduction of complication, but little is known about the relationship between timely intervention of the test that meet the guideline and chronic kidney disease (CKD). Aims :The purpose of this study is to assess the association between adherence to proposing HbA1c test guideline and CKD in type 2 diabetic patients. Methods:The incidence cases were the patients with type 2 diabetes mellitus identified from National Health Insurance Research Database (NHIRD) during 1999-2003. Cox regression was employed to evaluate the association between adherence to proposing HbA1c test guideline and CKD. Results:A total of 16628 patients were identified as newly diagnosed diabetes and 3987 (24.0%) of them developed CKD during the following period. The average duration of the following period was 6.85 years.Among 16628 patients, 8% followed the practice guideline for first two years of the following period and 23 % followed the practice guideline for two years before censor date.Comparing to patients not adherence to proposing HbA1c test guideline for two years before censor date, the hazard risk of CKD of adherence to proposing HbA1c test guideline were 0.306【95% CI=0.279-0.337】. Conclusions:Quality of care assessment should include care processes such as HbA1c testing. The study results and study methods may be of use to Type 2 diabetic patients in assessing the quality of care for diabetic patients.

Abstract Number	**P-1-25-18**
Presenter	Sara Gustavsson*, Björn Fagerberg, Gerd Sallsten, Eva Andersson
Exposure	no exposure
Health domains	diabetes
Type of research	others

To log-transform or not to log-transform: Regression on log-normal data, in models with abdominal adiposity as predictor for inflammation and insulin resistance

Background and Aims Much data in medical and environmental science can be described by a log-normal distribution, whereas many statistical analyses assume a normal distribution. It is common to log-transform the response variable in a regression analysis. Regression on a log-transformed response results in an exponential model (and an estimate of the relative effect of each predictor), whereas an untransformed response variable yields a linear model (and an estimate of the absolute effect). For two outcomes, CRP (inflammation marker) and HOMA-IR (insulin resistance), we fitted both an exponential and a linear model. The aim was to determine which model that fitted each outcome best. Data and Methods Data from a study of 64-year-old women (n=629), with different degrees of glucose tolerance, were used to quantify how each outcome (CRP and HOMA-IR) was associated with waist circumference (a known association). Ordinary least squares regression on log-transformed data (LSexp) was used to estimate the exponential model, and a maximum likelihood method based on the log-normal likelihood function (MLLN) was used to estimate the linear model. The best fit was assessed by explanatory power (R2). Also the log-scale residuals from each model (rLS and rML) were examined to see if the assumptions of constant variance, normality and random residuals were met. Results CRP: Neither rLS nor rML showed signs of heteroscedasticity. The residuals of LSexp deviated from normality and showed signs of an inverted U-pattern. The rML were normally distributed and showed no pattern. MLLN had a higher R2 than LSexp. HOMA-IR: Both rLS and rML had a skewed distribution and showed signs of heteroscedasticity. The rML showed a U-pattern. LSexp had a higher R2 than ML. Conclusions Based on the residuals and coefficient of determination, the linear model (estimated with MLLN) had a better fit for CRP, while the exponential model (estimated with LSexp) had a better fit for HOMA-IR.

Abstract Number	**P-1-25-19**
Presenter	Ashley Petit, Howard Kipen*, Pamela Ohman-Strickland, Robert Laumbach, Andrew Gow
Exposure	ambient air pollution
Health domains	diabetes
Type of research	others

Vascular NItric Oxide Production in Diabetics and Controls Following Acute Traffic Polllution Exposure

Background: Acute changes in air pollution are associated with changes in clinical cardiovascular outcomes within hours to days. Diabetics are at increased risk for these cardiovascular outcomes.. Loss of Endothelial derived nitric oxide (EDNO) is directly related to endothelial dysfunction, implicated in the acute and chronic pathogenesis of cardiovascular outcomes. Reactive hyperemia, a physiologic inducer of EDNO, is reported to be modified by both diabetes and air pollution. Aims: We aimed to study the impact of a 2 hour highway traffic commute on EDNO in Type II diabetics and controls. Methods: EDNO was assessed in 20 control and 20 Type II diabetic subjects before and after a 2-hr car ride. Plasma nitrite (NO2-) concentrations were measured, before and after reactive hyperemia, reflecting vascular endothelial production of NO, the most proximal measure of EDNO in the vasculature. Results: Baseline data before the ride showed higher resting NO2- levels in diabetics (230 nM, 191.3-276.8) than controls (182.6 nM, 155.6-214.1) ($p<0.06$), and greater increases in plasma NO2- following reactive hyperemia in controls (15.9%, $p< 0.02$) than in diabetics (1.8%, $p<0.8$). Post-exposure, the resting NO2- levels in diabetics decreased 18.3% ($p < 0.06$) and controls decreased 2.9% ($p< 0.08$); the response to reactive hyperemia was markedly reduced in controls and remained insignificant in diabetics. Conclusions: The car ride abolished the significant increase in plasma NO2- following reactive hyperemia in controls, implying reduced EDNO production. Within diabetics and controls, resting levels of NO2- decreased following the car ride, all suggesting a less responsive endothelium. These results point to altered NO metabolism in the diabetic vasculature that is further disturbed by a car ride and associated air pollution. Thus, acute air pollution exposure impairs production of EDNO more in diabetics than controls, consistent with its effect on cardiovascular events, and the greater susceptibility to air pollution of diabetics.

Abstract Number	**P-1-25-20**
Presenter	Jin Hee Kim*, Hye-Yin Park, Jung Dae Jeon, Young Lim Kho, Seung-Kyu Kim, Min-Seon Park, Yun Chul Hong
Exposure	organic compounds
Health domains	other
Type of research	randomized trial

Vitamin C supplementation protect from adverse effects of perfluorinated compounds on insulin resistance in the elderly: Community-based clinical trial

Backgrounds. Perfluorinated compounds (PFCs) are persistent organic pollutants which exhibit hormone disturbances in addition to hepatotoxicity, immunotoxicity, developmental toxicity, and tumorigenic potential. Aims. Whether PFCs affect insulin resistance (IR) and vitamin C intake protects against the adverse effect of PFCs was estimated. Methods. We designed a cross-over intervention study and assigned 141 elderly subjects aged ≥60 either to vitamin C or placebo treatment for 4 weeks in a random order. A 2-week washout period was implemented between the interventions. We measured serum levels of PFCs to estimate PFC exposures and urinary levels of MDA and 8-OHdG for oxidative stress. We also measured levels of fasting glucose and insulin and derived the homeostatic model assessment (HOMA) index to assess IR. Results. In 126 participants without a history of diabetes, PFOS and PFDoDA levels were found to be positively associated with HOMA index at the baseline and after placebo treatment (PPFOS=0.053 and PPFDoDA=0.01). Risks of IR determined as HOMA ≥ 2.5 for the top decile of PFOS and PFDoDA exposures were significantly elevated compared with those of less than top decile exposures (ORPFOS=2.2, PPFOS<0.0001; and ORPFDoDA=3.3, PPFDoDA<0.0001). However, the effects of PFOS and PFDoDA on HOMA were disappeared after vitamin C supplementation. Furthermore, at the baseline and after placebo treatment, PFOS and PFDoDA levels were also significantly associated with MDA (PPFOS=0.02) and 8-OHdG levels (PPFOS=0.001 and PPFDoDA=0.01) and MDA levels were positively associated with HOMA index (P=0.03). Conclusions. In the elderly without a history of diabetes, PFOS and PFDoDA exposures were positively associated with IR and vitamin C supplementation protects against the adverse effect of PFOS and PFDoDA.

Abstract Number	**P-1-28-01**
Presenter	Eun Kyoung Yang*, Yong Jin Jeon, Su Ryeon Noh, Gwi Heum Eom, Hyun Sook Bae, Jung Ah Kim, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	others
Health domains	mental health
Type of research	cohort study

A Follow-up Study on Mental Health of Residents in High Exposed Area After 4 Years of the Hebei Spirit Oil Spill

Background: There was a significant dose-response relationship between mental health outcomes and the number of days of clean-up activity and/or the distance from the accident point 1.5 years after the accident. Aims: To look into whether the residents have recovered from mental health or were still being affected mentally by the oil spill in highly exposed residents 4 years after the accident. Methods: We conducted two follow-up studies in 2010 and 2012 after the baseline survey in 2009 on 618 highly exposed inhabitants who have participated in all three surveys. We measured posttraumatic stress disorder (PTSD), depression, stress, and anxiety using Posttraumatic Diagnostic Scale (PDS), Center for Epidemiologic Studies Depression Scale (CES-D), Psychological Wellbeing Index (PWI), and State-Trait Anxiety Inventory (STAI), respectively. Results: Depression, psychosocial stress, and anxiety hardly decreased from the first survey to the second, and to the third survey, whereas PTSD significantly decreased. We divided two groups according to the distance among highly exposed residents to check the mental health recovery over time. The post-traumatic stress and trait anxiety in high-exposed group recovered slowly than the low-exposed group with a statistically significant difference. Conclusions: The mental health of highly exposed residents have not been fully recuperate yet 4 years after the accident. Therefore, follow-up studies are necessary to define long-lasing mental health due to the Hebei Spirit oil spill.

Abstract Number	**P-1-28-02**
Presenter	Roderick John Lawrence*, Joris Zufferey
Exposure	no exposure
Health domains	healthrelated quality of life
Type of research	others

Addressing Urban Health Challenges by Transdisciplinary Research and Practice

Professionals and policy makers have difficulty in explaining and measuring constancy, change and differences in health, built environments and ecological conditions in cities. This is not surprising given that these are complex and multidimensional. Hence they cannot be understood only in terms of the compartmentalized knowledge of disciplinary and professional concepts and methods. The traditional roles and responsibilities of scientists, policy makers and professional practitioners ought to be reconsidered because shortcomings in both empirical research and professional practice need correcting. In contrast to conventional disciplinary approaches, inter- and trans-disciplinary contributions offer a broader intersectoral approach. These innovative approaches have been applied but they are still not mainstream in either people-environment studies, or the practice of architecture and urban planning. The contributors will share their tangible experience. They have overcome obstacles to effective implementation in the following ways: 1. By action research that transgresses conventional disciplinary silos and professional borders in order to implement inter- and trans-disciplinary contributions that tackle the complexities of urban health. 2. By participatory design processes that involve stakeholders from both the public and private sectors as well as representatives of local communities. 3. By employing innovative decision making and communication tools that promote dialogue processes that enable consensus building. This paper presents several ways and means of overcoming the barriers to applying inter- and trans-disciplinary concepts and methods that are still not mainstream. The author refers to innovative contributions in the EU-FP7 project PHENOTYPE (Positive Health Effects of the Natural Outdoor Environment in Typical Populations in Different Regions of Europe) which is being funded from January 2012 to December 2015.

Abstract Number	**P-1-28-03**
Presenter	Maria Fiore, Giovanni Battista Modonutti, Elena Sentina, Vito Margherita, Fulvio Costantinides, Luca Leon, Margherita Ferrante*
Exposure	others
Health domains	mental health
Type of research	cross-sectional study

Alcohol training and alcohol habits of the medical students

Background The disease burden attributable to harmful use of alcohol is significant and in many countries public health problems caused by it represent a substantial health, social and economic concern. Across Europe, there is a clear gap in act the potential health interventions to reducing the alcohol harm. In primary health care settings, commonly fewer than 10% of people at risk of becoming hazardous and harmful drinkers are identified and fewer than 5% of those who could benefit from brief interventions are offered them. The health sector workforce in Europe is an enormous resource with great potential to affect positive change in alcohol-related diseases. Aims The level of alcohol training and alcohol habitsof the medical students in the University of Catania, Italy were investigated. Methods A cross-sectional study involving 5th year medical students was carried out. Students were recruited during lectures and a self-administrated questionnaire was used to collect alcohol training data. Alcohol habits were screened by the Alcohol Use Disorder Identification Test. Results A total of 170 students participated in the survey, aged between 22 and 30 years. 54.5% knows the meaning of "degree of alcohol". 72.0% knows the limit set by the highway code. 90.9% said that cannot recover from alcohol dependence syndrome. 15.9% of students think that a person must be an alcoholic to have health problems derived from alcohol. 80.3% of students know that drinking alcohol affects driving. The 87.9% know that alcohol causes intoxication stronger when mixed. 30% of the students are aware that in Italy the sale of alcoholic beverages is prohibited for children under 18 years. Harmful alcohol use was more prevalent among male (4.5%) than female students (3.0%).Hazardous drinking was found in 0.8% of studied subjects, more among men than women. Conclusions This study highlights the need for a greater and more relevant focus of alcohol education to medical students.

Abstract Number	**P-1-28-04**
Presenter	Stanislava Harizanova, Tanya Turnovska*
Exposure	others
Health domains	mental health
Type of research	occupational study

BURNOUT AMONG CORRECTIONAL OFFICERS IN BULGARIA

Background: Correctional environments are challenginganddangerous places of employment. The prison or jail organization, including overtime, rotating shift work, inmate violence, poor public image and low pay, creates stress and occupationalburnout for many officers. In Bulgaria at present burnout among employees working in prisons has not been studied. Aim: The main purpose was to assess the level of burnout among correctional staff working in a county prison-Plovdiv, Bulgaria. Methods: The only qualification in the sample selection was that the employee has direct contact with inmates. Four major constructs – demographic variables, burnout assessment, health outcomes, and personality characteristics – were included in a used questionnaire. The statistical program SPSS v.17.0 was used to process the data collected from the participants. A study was carried out with 99 correctional officers anonymously and on a voluntary basis. The sample was mostly male (93.94%), married (84.85%), and the average length of service was 10.02±6.06 years. The mean age of the participants was 37.66±6.6 years. Results: Data indicated almost 77% of correctional workers reported experiencing some symptoms of job burnout. Results indicated that younger (81%) and more educated (81.40%) reported increased levels of burnout. 100% burnout has been found among correctional officers with having personality dimension being introverted. High levels of burnout have been linked with a number of negative health outcomes such as headaches (25.8%), gastrointestinal disorders (27%), heart attacks (11.2%), physical exhaustion (43%), chronic anxiety (28.1%), insomnia (36%) and depression (41.6%). In the long term burnout produces maladaptive changes – increased use or abuse of alcohol (21.3%), substances (20%), smoking (41.6%). Conclusion: It was found high levelof burnout among correctional staff. The results confirm the need to explore the effective burnout strategies for reduction and prevent it.

Abstract Number	**P-1-28-05**
Presenter	Surianarayanan Mahadevan*, Simon Thomas, Kalpana Balakrishnan, Asit Baran Mandal
Exposure	others
Health domains	healthrelated quality of life
Type of research	time series study

COMBINED APPLICATIONS OF LEAN MANUFACTURING AND OSH IN LEATHER MANUFACTURING PROCESSES

Introduction The leather manufacturing process involves intensive manual laboring and there are copious opportunities to apply modern tools such as lean manufacturing for improved productivity and reduced occupational stress. The aim of the work is to assess the feasibility of extending the combined applications of lean manufacturing principles and OSH studies in a leather manufacturing unit in India. Method The lean manufacturing techniques used in this study are time and motion measurements. The ergonomic hazards as a result of work postures were independently assessed and later compared with the time-motion studies. The project involved the collection of videos of the various operations at the leather manufacturing unit. The collected videos were analyzed and the data obtained were compiled in the form of operation charts and time study sheets. Results The time taken for each element has been calculated and a table has been constructed for multiple cycles. The time taken for each operation when all suggestions have been implemented is estimated to give an idea of the time that can be saved. This resulted in a saving of 79.82 secondsand 15% reduction in the total movements throughout the entire process. Based on the sequence of operations followed for the two products produced in the largest quantities (nappa and suede), suggestions for modification of the plant layout have been provided. The proposals aimed at increasing the efficiency of the plant while keeping the costs involved in modification of plant layout to a minimum. An effort has been made to place consecutive operations as close together as possible in order to decrease transportation time and reduce manual labor handling. Conclusion This study has made a number of useful suggestions which if implemented, would result in higher productivity, worker safety, decreased worker fatigue and a more efficient usage of work space. This study can be considered a useful starting point for the modernization of the Indian leather industry as a whole.

Abstract Number	**P-1-28-06**
Presenter	Ara Jung*, Yun Dongmin, Yongbae Kim, Kiyoung Lee, Yoon-Hyeong Choi, Hongsoo Kim, Yun-Chul Hong, Sungroul Kim
Exposure	pesticides
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Comparison of environmental determinants for self-perceived health symptoms between seniros aged 60 years or older in urban and rural areas of South Korea

Background. The population aged 60 years and older in South Korea is increasing. Evidence-based risk management strategies should be employed to tackle health problems associated with an aging population. Aims. This preliminary study aims to compare the exposure prevalence to selected environmental risk factors in urban and rural areas, and to evaluate the association of self-perceived health symptoms with exposure to potential environmental risk factors among elderly individuals aged 60 years and older in urban and rural areas of South Korea. Methods. The participants of this convenience-based, cross-sectional exposure survey were people aged 60 years and older, who were randomly recruited from an urban (Cheon-An, N = 200) and rural (Asan, N = 276) area. Logistic regression analysis was used to assess the association of exposure to potential environmental risk factors (use of either mosquito repellents or petroleum at home, use of pesticide in agriculture as a long-term occupation, i.e., 10 years or longer) with the reported self-perceived health symptoms. Results. In the rural area, 76.4% of participants reported that they had at least 10 years of farming experience. The percentage of male and female participants who used mosquito repellents was 2.4 and 1.9 times higher, respectively, in rural areas than that in the urban areas ($p < 0.001$). The adjusted odds ratios (ORs) for self-perceived symptoms of palpitation, numbness, depression, and headache were higher in women who had long-term farming experience (10 years or longer) than that in those with little (3 years or fewer) or no farming experience (reference group). Conclusions. Our study showed that a difference in the frequency of exposure to selected environmental risk factors between the urban and rural area was positively associated with the difference in the prevalence of self-perceived health symptoms including palpitation, numbness, depression, and headache.

Abstract Number	**P-1-28-07**
Presenter	Anna Liisa Suominen*, Siru Wilskman, Timo Lanki, Pia K Verkasalo, Anu W Turunen
Exposure	persistent organic pollutants
Health domains	mental health
Type of research	cross-sectional study

ENVIRONMENTAL CONTAMINANTS AND FISH CONSUMPTION IN RELATION TO DEPRESSIVE EPISODES

Background Environmental contaminants are hypothesized to counteract the mental health benefits of fish and omega-3 polyunsaturated fatty acids (PUFAs). Aim To study whether environmental contaminants link to depressive episodes. Methods The participants of the Fishermen Study (n=309) represent a population with high fish consumption.The 12-month prevalence of depressive episodes was assessed by a self-report of two CIDI probe questions, and fish consumption (g/day) by a validated food-frequency questionnaire. Concentrations of PUFAs (% of fatty acids), dioxins (pg/g fat), and polychlorinated biphenyls (PCB, pg/g fat) were determined from serum whereas methylmercury (MeHg,ng/ml) from whole blood. Results The 12-month prevalence of depressive episodes was lower in the men (9%) than in the women (18%). Both the serum concentrations of environmental contaminants and PUFAs as well as fish consumption were higher in the men than in the women. Men without depressive episodes had statistically significantly higher serum concentrations of dioxins (mean 80 pg/g, 95%CI 69-91) and PCBs (59 pg/g, 50-68) compared with those having depressive episodes (43 pg/g, 22-65, 31 pg/g, 15-47, respectively). Similarly, men without depressive episodes reported to consume statistically significantly more fish (82 g/day,70-93) compared with those having depressive episodes (50 g/day, 28-71). The adjusted odds ratios for depressive episodes increased with decreasing concentrations of dioxins, PCBs or fish consumption but were no longer statistically significant. Regarding MeHg and omega-3 PUFAs in men and all the exposures in women, we observed no clear associations. Conclusions Our preliminary results do not support our hypothesis. The beneficial effects of high fish consumption on mental health may overrule the hazards of environmental contaminants. Environmental contaminants seem to serve as fish consumption biomarkers in this specific population

Abstract Number	**P-1-28-08**
Presenter	Adebimpe Usman Raheem*
Exposure	others
Health domains	healthrelated quality of life
Type of research	cross-sectional study

ENVIRONMENTAL SERVICES AND MULTIPLE HEALTH DISADVANTAGE IN DEPRIVED URBAN NEIGHBOURHOODS OF ILORIN, NIGERIA

The most striking difference between houses and neighbourhoods in deprived and non-deprived areas of African city is the availability of-and access to- environmental services. This paper examines the level of access to selected environmental services in deprived neighbourhoods of Ilorin and identifies the association between access to these services and the health status of urban residents. The study focuses on the twelve wards identified as deprived in a previous study. 480 households were sampled from the twelve wards which coincide with the indigenous and Frontier Native Area wards of Ilorin metropolis. A structured questionnaire was administered to the households in a multi-stage sampling technique to assess residential quality; and access to deprivable environmental services was examined using nine indicators which were aggregated to obtain an index of multiple deprivations. Deprived households were calculated as a proportion of the total household sampled and analyzed as continuous variables ranging from 0-100%. Health indicators were selected to capture health status perception, child health and health seeking behavior during illness and aggregated to obtain an index of multiple health disadvantages. The associations of deprivation in environmental services on multiple health disadvantages were examined using a multiple regression analysis of nine variables to identify the proximate determinants of multiple health disadvantages in the study area. The contribution of the independent variables on the explanation of the variation in multiple health disadvantagewas high (R2 =0.95) and statistically significant. Four variables were found to possess positive and significant contributions. The study concludes on the overall impact of environmental services on household health and the use of Index of Multiple Disadvantages in Health enables us to derive a quantitative measure of household health from indicators of household health conditions. This can be useful for targeting urban neighbourhoods according to their environmental peculiarities.

Abstract Number	**P-1-28-09**
Presenter	Pei-Chih Wu*, Ching-Chao Ju, Hui-chun Tsuang
Exposure	others
Health domains	mental health
Type of research	cross-sectional study

Examining the relationships between work-related stress and depression for nursing students by using saliva cortisol as a biological indicator

Background A higher number of stressors with negative health consequences have been addressed among nursing professionals. Nursing students face various stressors such as academic, clinical and personal, social stressors at work during their training period and may also influence their perceptions of stress on their future work. The release of cortisol has been recognized as an important response under physiological stress. Salivary cortisol has the advantages of noninvasive and high correlated with serum levels that is suit for large scale epidemiological study. Aims This study aimed to examine the relationships among work-related stress, depression and saliva cortisol levels on nursing students. Methods This cross-sectional study recruited 157 nursing students who are intern for more than 4 months from a collage located in southern Taiwan. Self-administrative questionnaire with personal characteristics, stress and depression scale were delivered at the time when they finish the training. Saliva samples were also collected and cortisol levels were analyzed by using enzyme immunosorbent assay (ELISA). Results Lack of interests on nurse, satisfaction of the arrangement of training clinics and hospitals, training performance, economic resources and gender were significantly associated with the score of stresses. Twenty students with " clinical signs of depression" which comprised 12.5% of the total students, have significantly higher scores of stress than those without signs of depression (P = 0.000). The levels of salivary cortisol were not correlated with the scores of stress and depression in our study. Further study is needed to examine the suitability of using salivary cortisol as a work stress induced biological indicator in cross-sectional study. Conclusions Our findings suggested school should provide consulting service to those students especially before and during internship to improve the conception of stress and depression among nursing students.

Abstract Number	**P-1-28-10**
Presenter	Côme Daniau, Carole Salvio, Vérène Wagner, Bénédicte Berat, Morgane Stempfelet, Florence Kermarec, Christine Ricoux, Pascal Empereur-Bissonnet, William Dab, Mathilde Pascal*
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Health and quality of life of people living near a chemical industrial area

Background: Communities living near industrial areas are not only concerned about the toxicological risks, but also about a set of risk factors integrating odors, noise, visual aspects and accidental events. They usually report health complaints including a wide range of symptoms, self-reported diseases, and poor quality of life. Aims: We present a study on the health and the quality of life of communities living near the major chemical industrial area of Salindres in Gard, France. Methods: A cross-sectional study was conducted on a random sample of 1 495 households, representative of the residents of 7 municipalities situated in a 5 km radius around the industrial area. The health outcomes were the general health perceptions (SF-36), the anxiety (SCL-ANX), sleep disorders (insomnia) and symptoms which can result from irritating and/or allergenic properties of chemical substances emissions of industrial activities. The exposure was estimated through the modeled atmospheric pollution and people perception of the industrial pollution. The attitudes towards the industrial activities (believes, worries and behaviors) were studied as interaction factors in the relation between psychological health and perceptions of the pollution according to the transactional theory of environmental stress. The study associated quantitative and qualitative methods. Results: The survey achieved a 52% response rate. The phone questionnaires were administered in October-December 2012. The data analysis will be ended in June 2013 and the results will be presented during the conference. Conclusions: This epidemiologic study, completed by a quantitative risk assessment and a cluster investigation of a perceived excess of diseases, was designed to perform a comprehensive evaluation of the local public health issue. This approach is consistent with the multifactorial characteristics of the exposure to industrial activities, integrating psychological and social factors of health.

Abstract Number	**P-1-28-11**
Presenter	Eun Kyoung Yang*, Yong Jin Jeon, Jung Nam Sohn, Su Ryeon Noh, Gwi Heum Eom, Hyun Sook Bae, Jung Ah Kim, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	others
Health domains	mental health
Type of research	cross-sectional study

Mental Health in Residents 1.5 Years After the Hebei Spirit Oil Spill

Background: The assessment of the acute-phase mental health of the residents in the oil spill area showed a high degree of risk. Aims: The study intends to analyze the correlation between the damage of oil spill and mental health of the residents in the oil spill area, and identify the status of residents' mental health according to the distance from the point of accident and the number of day for clean-up operation. Methods: The community survey of 9,246 residents was conducted 1.5 years after the oil spill accident. PTSD, depression, stress and anxiety were performed using the Posttraumatic Diagnostic Scale, Center for Epidemiologic Studies Depression Scale, Psychological Wellbeing Index, State-Trait Anxiety Inventory, respectively. Results: After adjusting for the covariates, the risks of having the symptoms of PTSD (OR 2.80, OR 3.24), depression (OR 1.13, OR 1.95), stress (OR 1.22, OR 1.36), and/or trait-anxiety (OR 1.52, OR 1.64) increased significantly according to the distance from the oil spill point to the residence and the total number of days of clean-up of participation.. conclusions: A higher rate of symptoms of mental health was found as the residents live closer to the accident point, and participate in longer clean-up work duration. it necessary to monitor the long-term mental health in residents

Abstract Number	**P-1-28-12**
Presenter	Thanusin Saleeon*, Wattasit Siriwong, Thomas A. Arcury, Mark Gregory Robson
Exposure	others
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Occupational Exposure and adverse health effects to Dermal Nicotine for Thai TraditionalTobacco Farmers in Nan Province, Northern Thailand

Background: Thai Traditional Tobacco (Nicotiana Tabacum L.) as known as a non- Virginia type. A matured leaf contains more nicotine compare to Virginia type (3-4 times).In general process of tobacco production may lead to adverse health effect as Green Tobacco Sickness (GTS) Aims: To determine the prevalence of subjective health symptoms from occupational exposure with nicotine in Thai traditional tobacco production and to estimate potential risk factors associated with nicotine exposure from Thai traditional tobacco. Method: A cross- sectional study was conducted with 473 Thai traditional tobacco farmers in Praputtabath Sub-District and Phator Sub-District. The farmers were randomly selected and interviewed using face to face questionnaires. Results: Half of farmers were males (50.7%), the age of the famers were in the range of 20-65 years. During week period, the prevalence of subjective health symptoms from Thai traditional tobacco activities of headache and dizziness were 28.60% and 16.55%, respectively. The logistic regression analyses revealed that on the process, snapping off of tobacco leaves were associated with headache(OR6.875, 95%CI1.293-5.924) and dizziness(OR4.801, 95%CI0.077-0.867) and process of removing tobacco bud were associated with headache (OR10.775, 95%CI 1.644-7.167), dizziness (OR 8.195, 95%CI 1.505-8.890)and Nausea (OR5.497, 95%CI 1.400- 43.125). Additionally, during watering were independently associated with exposure to nicotine form wet tobacco leaves and wearing wet clothes (61%) (OR22.676, 95%CI 0.674 -0.848). During watering, the farmers exposured to wet leave and cloth about 6 hours per day and some of them reported on rash and/or irritate skin (29%). Conclusion: The study revealed that dermal pathway is a major route of exposure. Body soaking during watering may increase adverse health effects related to GTS. The health education program for increase awareness about health risk exposure of farmers is recommended.

Abstract Number	**P-1-28-13**
Presenter	Khaled Hassine*, Thouraya Annabi Attia, Ghozlane Fleury-Bahi
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Perceived neighborhood environment and adults health in three Tunisian cities

Background. Few studies have examined the association between local environment and health. Aims. This study aims were to develop and validate an environmental quality of life scale and to determine which neighborhood environmental variables were associated with health status Methods. From May to June 2011 a cross-sectional study was performed on residents (n= 1523) living in three Tunisian cities through a face to face interview. The interviews included the whoqol-bref, a health questionnaire and a scale of the daily residential and environmental quality of life. Factor analysis was used to identify dimensions from the environmental quality of life characteristics. Self rated health, mental health and a composite health score constituted the outcomes variables. Logistic regression was used to examine the relationship between health status and the environmental quality of life dimensions. Results. The identified environmental quality of life dimensions were, Image of the neighborhood (Cronbach's alpha =.83), Annoyance and pollution (Cronbach's alpha = .84), and Shops and services (Cronbach's alpha = .66). The confirmatory factor analysis showed the stability of the three factors in this model. Logistic regression analysis adjusted for locality, age, gender, educational level,type of housing, family status, years of residence in the neighborhoodand household income, showed that only the factor annoyance and pollution was associated with the three health outcomes. Additionally the Image of the neighborhood had stronger association with mental health. Conclusion. The environment quality of life scale used at three sites appears as an interesting tool to better investigate the local environment and to show how it is perceived by residents .Perceptions of local environmental characteristics were found to be associated with level of health in adults.

Abstract Number	**P-1-28-14**
Presenter	Georgina Vega Fregoso*, Silvia Graciela Leon Cortes, María Guadalupe Garibay-Chávez
Exposure	others
Health domains	healthrelated quality of life
Type of research	others

Percepción Social del Riesgo Químico - Tecnológico: Una mirada desde los actores locales

Introducción. El 70% de la industria química en América Latina se concentra en países como Argentina, Brasil y México, cuestión que no ha cambiado en los últimos años y pone de manifiesto la vulnerabilidad de la región ante las amenazas por sustancias peligrosas. Objetivo. 1. Dar cuenta de la percepción social del riesgo químico – tecnológico de los habitantes de la comunidad. 2. Identificar relación entre las enfermedades que los habitantes de la pequeña ciudad de Atequiza en el estado de Jalisco, México asocian (cáncer, dolores de cabeza permanentes, problemas dermatológicos y respiratorios) en los registros epidemiológicos. Métodos. 1. Etnografía. 2. Cuestionario. 3. Talleres Participativos con Niños y Adolescentes. Resultados. Los padecimientos reportados por la gente no tienen correspondencia con el registro realizado en Boletines Epidemiológicos. Niños más pequeños (5-7 años) no poseen aun percepción del riesgo químico tecnológico, conforme avanzan en edad (11-13 años) la percepción se incrementa. Población adulta considera de ocurrencia muy probable los riesgos socio organizativos: robos, narcotráfico y accidentes de tránsito, en segundo lugar los riesgos químico – tecnológicos se identifican como de probable ocurrencia (fugas, explosiones, incendios). Conclusiones. La no relación de las enfermedades sentidas por la comunidad y las reportadas en datos oficiales puede deberse al subregistro.Percepción social del riesgo químico – tecnológico de la comunidad relacionado nivel educativo, género y edad. Ocurre el fenómeno de “inmunidad subjetiva” (Douglas, 1996, 2000; Wildavsky,1982) y del “neighborhood halo effect” (Bickerstaff K, Walker G., citado en Catalán, 2009) entre los habitantes.

Abstract Number	**P-1-28-15**
Presenter	Carmen Freire*, Sergio Koifman
Exposure	pesticides
Health domains	mental health
Type of research	review

PESTICIDES, DEPRESSION AND SUICIDE: A SYSTEMATIC REVIEW OF THE EPIDEMIOLOGICAL EVIDENCE

Background: It has been suggested that high exposure to pesticides, including poisoning, experienced by agriculture workers and rural residents may result in an elevated risk of psychiatric disorders and suicidal behavior. Epidemiological data supporting this hypothesis are very limited. Aims: To review the epidemiological evidence on the relationship of pesticide exposure with depression and suicide. Methods: An updated systematic review was conducted in the scientific literature on the topic published between 1997 and 2012 by using MEDLINE database. Results: A total of 11 studies on depression and 14 studies on suicide were identified. Depression or other psychiatric disorders have shown increased risks associated with previous pesticide poisoning in 5 studies, with statistically significant odds ratios (OR) ranging from 2.08 to 5.95. Lower risk estimates have been found for chronic pesticide exposure. Among studies on suicide, 4 reports found increased suicide mortality rates in areas with intensive pesticide use (OR between 1.60 and 2.61) compared to areas with lower pesticide use. Occupation in agriculture has shown a significant association with higher suicide risk than other occupational groups in 4 studies (OR between 1.30 and 4.13), but not in one report. Regarding specific pesticides, lifetime use of chlorpyrifos was related with increased suicide mortality (OR=2.37, 95%CI=1.03-5.48) in one study. Conclusions: Epidemiological evidence of association between pesticide exposure and either depression or suicide has been reported in studies using varying epidemiologic approaches, but evidence remains limited and inconclusive. Review of the literature warrants further research to explore such relationships, in particular prospective studies among large samples of both high- and low-dose-exposed workers. Detailed exposure assessments and evaluation of other potential sources of psychological stress are required.

Abstract Number	**P-1-28-16**
Presenter	Elena Righi, Barbara Forresi, Francesco Soncini, Cinzia Del Giovane, Roberto D'Amico, Ernesto Caffo, Gugliemina Fantuzzi, Gabriella Aggazzotti*
Exposure	others
Health domains	mental health
Type of research	cross-sectional study

Prevalence and risk factors of Post-Traumatic Stress Disorder in children and adolescents after the 2012 earthquake affecting the Emilia Romagna Region (Italy)

On May 2012, two major earthquakes hit the Province of Modena (Emilia Romagna Region, Northern Italy): the country suffered 27 deaths and several hundred injured citizen; 15000 local resident were left homeless. Post-Traumatic Stress Disorder (PTSD) is a major debilitating psychological disorder that frequently occurs after natural disasters, including earthquakes, with a prevalence ranging, according to different authors, from 28 to 70%. Many cases will remit within 12 months, however about one-third of cases will have a chronic course. Given the high PTSD rates in children and adolescents, the long term impact on their well-being and the relevant social costs of chronic mental disorders, it is of primary importance to recognize and effectively treat cases as soon as possible and to identify potential individual and social risk and protective factors to be addressed in future effective preventive interventions. An epidemiological cross-sectional study has been set up and is on progress in a randomly selected sample of school children and adolescents (9-14 years) exposed to the earthquake with the aim to assess the PTSD prevalence and to explore potential risk (demographic, parental factors and level of trauma exposure) and protective factors (e.g. social support) associated to PTSD development and persistence. The assessment protocol includes the administration of an exposure questionnaire on objective/subjective experiences during the earthquake, the UCLA PTSD Index for DSM-IV questionnaire, and the Strengths and Difficulties Questionnaire. Parental symptomatology will be also assessed using the Symptom Checklist-90-R questionnaire, in order to evaluate the influence of parental psychopathology on children conditions. The present research will have important implications for the prevention in Italy of chronic PTSD, for treatment of traumatized children and adolescents, as well as for the development of effective post-trauma interventions.

Abstract Number	**P-1-28-17**
Presenter	Hirata Mamoru*, Yoshida Tatsuo
Exposure	organic compounds
Health domains	mental health
Type of research	others

Psychological burdens on developing process of idiopathic environmental intolerance among patients

Background: So-called “multiple chemical sensitivity” may be an issue of environmental medicine. Patients with the disease complain various symptoms and limit their lives. However, WHO-IPCS applies the name of idiopathic environmental intolerance (IEI) to the disease owing to indistinctness of contribution of chemicals. In our experiences in out-patient clinic, patients with IEI are understandable through psychiatric diseases including PTSDor the results of psychological factors, but not based on toxicological standpoints. Aim: In the present study, we aimed to clarify the correlation of psychological factors on developing of IEI among patients with IEI. Methods: In the first medicalvisit patients of to our out-patient clinic from April 2009 to January 2013. 42 patients (7 men and 35 women) compatible with standard of “1999 Consensus of Environmental Medicine in USA” were included. Their age of the developing of IEI ranged from 23 to 76 (51.1±13.7) years. We obtained detailed medical history including exposure to chemicals (including odour levels) and psychological burden factors (PB) for the patients before the development. Results: Eleven patients were exposed to chemicals sufficient to induce toxicologically significant symptoms (Ex), 19 patients to odour levels (Od) and 12 with unclear exposure (Un). The number of patients with PB were 31, without 8 and unclear 3. PBs were as follows: health issues of her/himself, close relative or close friend (n=11), stress in workplace (n=8), conflict with close relative (n=7), close leave or loss of relative or close friend (n=4) and others. The rate of PB (+) patients in Od (n=16) was significantly higher than that of PB (+) in Ex (n=5) [Fisher’s exact test, p=0.0419], and that in Un (n=10) was more than that in Ex [p=0.0894], but not significant. Conclusions: The results suggested that psychological burden may be an important factor in developing process of IEI.

Abstract Number	**P-1-28-18**
Presenter	Lilia Patricia Bustamante-Montes*, María Hernández-Valero, Patricia Borja-Bustamante, Erendira Flores-Meza, Miguel Ángel Karam-Calderón, Martha Campuzano-González
Exposure	others
Health domains	cancer
Type of research	case-control study

Psychosomatic and social factors in breast cancer

Background. Breast cancer is a complex disease with a wide array of multiple causes that requires its study to include environmental, biological, psychological and social factors. Aims. To evaluate the association between breast cancer and psychosomatic factors e.g., alexithymia, type c personality, depression, rationality, expressiveness and harmony and social determinants such as night work. Methods. We conducted a case-control study among women histologically diagnosed with breast cancer (cases) treated at the Centro Oncológico Estatal del Estado de Mexico. The controls were women without breast cancer (by mammography) matched to the cases on age (± 5 years), residency, insurance health status, and without a family history of breast cancer. Mean differences, difference in proportions and conditional logistic regression were conducted. Results. No associations were found between breast cancer and socio-demographic characteristics, tobacco and contraceptive use. Statistically significant associations were observed between breast cancer and alexithymia, depression, expressiveness, rationality and harmony and night work ($p< 0.001$). The multivariate model indicated that alexithymia, depression and night work explained 66% of the variability. Conclusions. Breast cancer has been associated with environmental and genetic factors. However, the results of this study show that psychosomatic and social factors may also contribute to the development of this disease.

Abstract Number	**P-1-28-19**
Presenter	Whitney Cowell*, Julie Herbstman, Virginia Rauh, Lori Hoepner, Frederica Perera, Robin Whyatt
Exposure	others
Health domains	healthrelated quality of life
Type of research	cohort study

Relationship between housing quality and maternal stress in a prospective birth cohort

Background and AimResearch demonstrates substandard housing is associated with elevated psychological distress and increased exposure to household toxicants, including lead and pesticides. This is noteworthy as both stress and these exposures have been independently associated with adverse neurodevelopment. Here, we sought to determine if poor housing quality and negative perceptions of the home environment are associated with increased maternal stress and demoralization in an ongoing prospective birth cohort. MethodsThe study population consisted of 516 African American and Dominican mother-child pairs recruited from Northern Manhattan and the Bronx. Data on housing characteristics were self-reported during structured interviews at child age 5 years. Maternal psychological distress and perceived stress were measured with the Psychiatric Epidemiology Research Instrument Demoralization Scale (PERI-D) and Cohen's Perceived Stress Scale (PSS), respectively, at age 5 years. We computed t-tests to assess differences in mean PERI-D and PSS scores by the following binary variables: crowding, instability (frequent moves), housing disrepair, perceived living conditions, and rent hardship. We summed the housing conditions to create a continuous variable ranging from 0-5 and conducted regression analyses to examine the association between housing quality and both stress scales, controlling for income, race/ethnicity, and maternal education. ResultsAll t-tests resulted in significant differences ($p<0.05$) in mean PERI-D and PSS scores by each housing condition. We found significant linear associations between housing quality and demoralization ($\beta=0.23$, 95% CI: 0.19, 0.28) and perceived stress ($\beta = 2.38$, 95% CI: 1.86, 2.89) when adjusting for all covariates. ConclusionsIn this prospective cohort, adverse housing conditions were associated with elevated maternal stress. These results support our next steps, which include investigation of the relationship between housing stress and exposure to household toxicants on child neurodevelopment.

Abstract Number	**P-1-28-20**
Presenter	Etsuji Suzuki*, Saori Kashima, Ichiro Kawachi, S. V. Subramanian
Exposure	others
Health domains	mental health
Type of research	others

The effects of varying social contexts on growing geographical inequalities in suicide in Japan: a multilevel analysis from 1975 to 2005

Background: Given a range of factors associated with suicide that relate to distal as well as more proximate causes, there is an interest in investigating inequalities in suicide in terms of varying social contexts as well as individual socioeconomic status. Aims: To examine the contextual effects of prefecture-level socioeconomic status on suicide risk, controlling for individual age and occupation in Japan. Methods: Based on quinquennial vital statistics and census data from 1975 to 2005, we analyzed the entire population aged 25 to 64 years. The total number of suicides was 75,840 men and 30,487 women. As indicators of varying social contexts, we obtained the following 3 variables for each prefecture and divided them into tertiles; Gini coefficients for yearly income, average yearly income, and average savings. For each sex, we estimated odds ratios (ORs) and 95% credible intervals (CIs) for suicide using multilevel logistic regression models with cells (cross-tabulated by age and occupation) at level 1, 7 different years at level 2, and 47 prefectures at level 3. Prefecture-level variance was used as an estimate of geographical inequalities in suicide. Results: We found that, even after adjusting for individual age and occupation, low average savings at prefecture level were associated with a higher risk of suicide among men (OR in low vs. high savings: 1.12, 95% CI: 1.04-1.21), while no clear patterns were observed with other variables. When we further examined the associations in year-specific models, both average yearly income and average savings were inversely associated with suicide risk in recent years. No clear association was found between prefecture-level income inequalities and suicide risk for either sex. Conclusions: Prefecture-level deprivation was associated with a higher risk of suicide in recent years, primarily among men, which implies that it is a driving force behind the growing geographical inequalities in suicide.

Abstract Number	**P-1-28-21**
Presenter	Darluce Oliveira*, Lirandina Gomes
Exposure	others
Health domains	healthrelated quality of life
Type of research	others

The environmental healt rishs at the surrounding area of touristic and hotel enterprises in Brazil.

THE ENVIRONMENTAL HEALTH RISKS AT THE SURROUNDING AREA OF TOURISTIC AND HOTEL ENTERPRISES IN BRAZIL DARLUCE DA SILVA OLIVEIRA Professora Adjunta (Assistant Professor) Universidade do Estado da Bahia (Brasil) dsoliveira05@yahoo.com.br LIRANDINA GOMES Professora Adjunta (Assistant Professor) Universidade do Estado da Bahia (Brasil) liragomes11@yahoo.com.br ABSTRACT: The environmental health risks resulted from the implantation of touristic and hotel enterprises has been creating big discussions in the academic and business area, due to the environmental impacts occasioned by the complexity of the occupation process of the use of the territory and natural resources at this localities. The companies that appropriate those spaces utilizes the compensatory and mitigation measures proposed in the EIA/RIMA and in the process of environmental licensing with the meaning of social and environmental responsibility, and in most of times same as marketing. In this context, this research raises the question: How the spaces occupied by the Iberian hotel chains in Brazil have been contributing for the environmental health risks in the surrounding areas of their enterprises? Therefore, the main objective of this work aims to analyze the environmental health risks caused by the Iberian hotel chains in Brazil, with emphasis at the northeastern littoral and north of Bahia, considering the impacts materialized in the surrounding areas of those enterprises. Throughout the qualitative methodology, the results indicated categories at the sanitation area, environmental health, real state enterprises and environmental impacts. The conclusions emphasises the valorisation of the spaces, their transformations and the environmental health risks at the surrounding areas of those enterprises. Keywords: environmental health, sanitation, real state enterprises, environmental impacts.

Abstract Number	**P-1-28-22**
Presenter	Jessie Carr, Laura Kubzansky, Ogonnaya Dotson Newman, John D. Spengler, Peggy Shepard, Jane Clougherty*
Exposure	others
Health domains	other
Type of research	cross-sectional study

Validating community stressors using individual data on perceived stress across New York City (NYC)

Background: Chronic psychological stress has been linked to respiratory health, both independently and in combination with air pollution. Understanding relationships between individual stress perception and community stressors (e.g., noise, violence) is important for accurate exposure assessment. Aims: We aimed to validate relationships between individual stress perception and GIS-based indicators of social stressor exposures, through a citywide survey, across two seasons. Methods: Our spatially-stratified survey captured a range of psychosocial domains, including neighborhood disorder, crime and violence, stress and mental health, individual and community-level buffering resources, and asthma outcomes. We compared survey data with GIS-based publicly-available indicators of community social stressors. Results: We identified substantial variability in perceived stress across individuals (n=780) and communities. Though most correlations were in the hypothesized direction, associations between individual and community stressors were weaker than expected. Indicators of violent crime and deprivation were correlated with perceived neighborhood crime, loitering, vermin, and vandalism (r= 0.19 to 0.25). Built environment indicators (e.g., housing violations) were inversely correlated (r= -0.06 to -0.22) with perceived cleanliness and caretaking of properties. Asthmatics with recent exacerbation events reported higher perceived stress and lower social capital, compared to asthmatics without recent events. Winter survey analysis, and comparison across seasons, is on-going. Conclusions: Relatively weak associations between community and individual-level stressor indicators may point to wide variability within communities, or in individual appraisal of community attributes. Characterizing spatial and social patterning in perceived stress, and validating the resonance of publicly-available stressor indicators, can clarify the role of chronic stress as a potential modifier of environmental exposures, and a contributing factor to environmental health disparities.

Abstract Number	**P-1-28-23**
Presenter	Chien-Yuan Huang*, How-Ran Guo
Exposure	no exposure
Health domains	mental health
Type of research	cross-sectional study

Work stress and related risk factors among high tech male workers in southern Taiwan

Background: Work stress, which might lead to the accumulation of stress and lead to various physical and mental illnesses, has become an important issue among workers in the high-tech industry. There is gender difference between work stress and shift work. Aim: We conducted a study to evaluate the associations between work stress and male shift worker among high tech company. Methods: We recruited workers working in a scientific park in southern Taiwan from January 1 to December 31, 2011. Information on demographic characteristics was collected through a self-administrated questionnaire. Participants also completed a job content questionnaire and reported habits of smoking and drinking. Results: There were 1193 male workers participated in this study. We observed positive associations between work stress and marriage status, shift work, seniority, burnout for personal reasons, work-related burnout, over-commitment, and client-related burnout (all with $p < 0.05$). After adjusting for other factors, we found higher seniority [6-10 years (adjusted odds ratio [AOR] =1.61, 95% confidence interval [CI]: 1.04-2.50); >10 years (AOR =1.74, 95% CI: 1.12-2.68)] , day work (AOR =1.40, 95% CI: 1.01-1.93), and burnout for personal reasons (AOR =2.09, 95% CI: 1.19-1.93), were independent risk factors of work stress. Conclusion: Among the high tech male workers, work stress is associated with day work, higher seniority and burnout for personal reasons. Therefore, intervention strategies for work stress should take into consideration these factors.

Abstract Number	**P-1-32-01**
Presenter	Benoît Lalloué*, Jean-Marie Monnez, Cindy Padilla, Wahida Kihal, Denis Zmirou-Navier, Séverine Deguen
Exposure	others
Health domains	policy
Type of research	exposure modeling

Accounting for complex environmental exposure situations: a classification approach

Background: Everyone is subject to environmental exposures from various sources, with negative health impacts (air, water and soil contamination, noise...) or with positive effects (e.g. green space). Studies considering such complex environmental settings in a global manner are rare. Aims: We propose to use data mining techniques to create a composite exposure index with a data-driven approach, in view to assess the environmental burden experienced by populations. We illustrate this approach on a large French metropolitan area. Methods: The study was carried out in the Great Lyon area (France, 1,260,348 inhabitants in 2007, 527 km²) at the census block group (BG) scale. Indicators on NO2 annual concentrations, noise levels, proximity to green spaces and to industrial plants, and road traffic were synthetized using Multiple Factor Analysis (MFA), which allows to explore the relations between exposures and BGs without a priori knowledge, and to synthetize indicators of different types. Hierarchical clustering was then used to create BG classes. Results: The four first components of the MFA explained respectively 23, 14, 13 and 12% of the total variance. Clustering in 3 classes group: 1) BGs far from industries, greener and with less noise and air pollution than the average; 2) BGs close to industries with less green spaces and air pollution than the average; and 3)BGs far from industries but with higher levels of noise, air pollution and traffic. Greater numbers of classes were tested in order to assess a variety of clustering. Conclusions: We present a data driven approach using data mining techniques, which seem overlooked for cumulative exposure assessment in complex environmental settings. Although it cannot be applied directly for risk or health effect assessment, the resulting index can help to identify hot spots of cumulative exposure, to prioritize urban policies or to compare the environmental burden across study areas in an epidemiological framework.

Abstract Number	**P-1-32-02**
Presenter	Mui Kwok Wai*, C T Cheung, L T Wong
Exposure	others
Health domains	policy
Type of research	cohort study

Benchmarking Indoor Environmental Quality (IEQ) in Air-conditioned University Classrooms

Urban living people spend over 90% of time in indoor. Significant negative impact on occupant's health due to poor indoor environmental quality (IEQ) is confirmed. Maintaining satisfactory level of IEQ for classrooms is thus a prime strategy to protect students' health and enhance learning performance. The IEQ in teaching rooms is evaluated from the occupant's acceptance in thermal comfort, indoor air quality (IAQ), visual and aural comfort. Students' adaptive responses to the perceived indoor environment and the corresponding environmental quality parameters are respectively evaluated by subjective interview surveys and physical measurements. A multivariate logistic regression model of an IEQ index associated with the four comfort criteria is developed to benchmark the classrooms via a five-star rating system. A range of acceptable IEQ for common classroom conditions is determined and its correlations with the dependent environmental parameters are studied. In addition, the major determining factor leading to IEQ complaints is reported. The proposed benchmark can be applied as quantitative assessment criterion for future classroom environment design where evaluation of students' health and IEQ acceptance is expected.

Abstract Number	**P-1-32-03**
Presenter	Alena Bartonova*, Aleksandra Fucic, Hans Keune, Arno Gutleb, Peter van den Hazel, Janna Koppe, the HENVINET consortium Http://www.henvinet.eu
Exposure	others
Health domains	other
Type of research	others

Bringing assessments from committees to research communities: a perspective

Background Impact assessment requires knowledge and data. For emerging issues, assessments of health risks are often done in expert committees. While such assessments are highly credible to policy makers, they do not allow participation of wider research community that may bring in plurality of views and ideas. Aims The main aim was to develop methods for better linking of the environmental health research community with policy making domain in an assessment framework. Specific aim was to develop a web-based assessment tool to evaluate (gaps in) knowledge for impact assessment. Methods We developed an an online expert evaluation tool based on Drivers-Pressures-State-Impact-Response (DPSIR) operational framework. Methodological steps involved (1) review of available literature following the DPSIR (2) development of an internet-based questionnaire (3) recruitment of experts for evaluation (4) assessment of the evaluation results (5) prioritization of knowledge gaps and possible mitigation actions (6) development of a policy brief with recommendations. Results The tool was used for seven dissimilar environmental health issues (climate change and respiratory disease, two brominated flame retardands, phthalates, a pesticide for home use, environmental cancer risks, and environmental occurence of nanoparticles), of which five ended in a policy brief, but all provided information on knowledge gaps. The DPSIR proved useful for systematization and communication of the issues. Main challenges were related to communication and interest raising: common consortium understanding, recruitment of experts for evaluation, and linking to policy/decision making. Conclusions Interest of the decision/policymakers is essential for bringing environmental health topics on the agenda. Thus, scientists, and not only committee members, need to understand the policy cycle, and the different aspects of science-policy communication process. Our experience from the process we underwent in developing these methods may provide useful guidance to others.

Abstract Number	**P-1-32-04**
Presenter	Keith Dear*, Sotiris Vardoulakis
Exposure	no exposure
Health domains	other
Type of research	others

Challenges and Opportunities for Urban Environmental Health and Sustainability: HEALTHY-POLIS

Rapid urbanisation, especially in the Asian-Pacific region, is stretching natural resources and threatening environmental quality. Similarly, densely populated urban areas in Europe are facing environmental health challenges including contamination of air, water and soil. Sprawling urban areas worldwide contribute to traffic congestion, with associated air pollution and long commuting times affecting public health and productivity. Climate change is likely to aggravate certain health risks by increasing the frequency and severity of extreme weather events (heatwaves and floods) and potentially contributing to air pollution episodes (ground-level ozone and pollen). On the other hand, climate change mitigation and adaptation policies can provide a range of health co-benefits associated with active transport, low carbon buildings, renewable energy generation and sustainable food consumption. Cities are complex systems that demand systems-based, interdisciplinary research methods involving epidemiologists, toxicologists, urban planners, environmental and public health scientists. Methodological innovation and standardisation of epidemiological and risk assessment methods across countries, are needed to address complex environmental health challenges in the context of climate change and sustainable development. Relevant areas include the assessment and reduction of the health risks and impacts of weather extremes, air pollution and other forms of environmental contamination, as well as assessing and promoting the potential health benefits of climate change mitigation and adaptation. We are proposing to set up an international consortium on urban environmental health to: (1) promote innovation and standardisation in research methods, (2) facilitate international, multi-disciplinary research collaborations, (3) provide training and promote capacity building especially in rapidly urbanizing countries, and (4) evaluate and promote environmental interventions to improve public health in cities.

Abstract Number	**P-1-32-05**
Presenter	Emiko Minakuchi*, Kouichi Nakazawa, Momoko Kayaba, Masahide Kondo, Yasushi Honda
Exposure	climate change (temperature)
Health domains	policy
Type of research	cross-sectional study

Change of cooling appliance usage of elderlies: Before and after the Fukushima nuclear power plant accident

Background: After the Fukushima nuclear power plant accident on 11th March, 2011, the Japanese government implemented a power-saving drive even in the household. However, it is generally known that using the cooling appliance is one of the important measures to reduce the risk of indoor heat stress; especially for elderly people, who are susceptible to such hazard. We therefore surmised that the cooling appliance usage of elderlies was decreased after Fukushima nuclear accident, which would be a problem in terms of adaptation to heat stress. Aims: To understand whether the behavioral change in the cooling appliance use of elderlies had occurred by adjuration of the power saving after the Fukushima nuclear power plant accident. Methods: We conducted a web-based questionnaire survey in eight urban areas during winter of 2011 and 2012; before and after the accident. Households with persons aged 65 and over were selected as samples from panel members of a research firm, and the oldest member of each household was queried about his/her usage of cooling appliances. We compare the differences of the data before and after the accident. Results: Among the 3155 participants, people who do not use the appliances during both activity time and sleeping time in 2011 increased approximately by 2% compared to those in 2010. Also, people who turn the appliances on only when the room temperature were 28℃ or above increased by 3%. Compared with other cities, the change was larger in Sendai, where the influence of the nuclear accident was greatly received. Conclusions: The use of cooling appliance by elderlies decreased after the Fukushima nuclear power plant accident. Acknowledgments:This study was funded by the Environment Research and Technology Development Found S-8 from Ministry of the Environment, Japan.

Abstract Number	**P-1-32-06**
Presenter	Jihyun Lee*, Jong-Hyeon Lee, Chan-Kook Kim, Marianne Thomsen
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	exposure modeling

Childhood exposure to DEHP, DBP and BBP under existing chemical management systems: A comparative study of sources to aggregate exposure in Korea and in Denmark

Since early 20th century, phthalates have been widely used as plasticizers. Due to the potential for adverse health effects - particularly reproductive effects - for vulnerable population such as children, phthalates like Di(2-ethylhexyl) phthalate (DEHP), Di-n-butyl phthalate (DBP) and Benzyl-butyl phthalate (BBP) have been gradually under regulations. Despite the similar adverse health effects, no harmonized regulations exist for these substances. Varying regulations are focused on single/multiple substances in separate product categories, e.g. toys, childcare articles, cosmetics and food packaging materials. Cumulative risks of DEHP, DBP and BBP to children in Korea and Denmark were estimated based on exposure via the environment and food. While the estimated risk was higher in Korea with a median RCR of 0.32 (KR) vs. 0.16 (DK), the back calculated risk from urinary metabolites was higher in Denmark with a median RCR of 0.91 (DK) vs. 0.62 (KR) (unpublished results). The present study aims to assess the aggregated exposure from consumer products assuming that every single product's regulatory standard is respected. Total exposure to the three phthalates will be estimated taking into account different consumption patterns and life styles of children in Denmark and Korea. The estimated exposure from products will be added to the exposure via the environment and foods and total exposure will be compared to biomonitoring data. The result will verify the appropriateness of current product regulations for DEHP, DBP and BBP such as REACH and directives on cosmetics, building materials, toys and childcare articles. Furthermore, the need for a system approach (Lee et al., 2013) which links existing chemical regulations with environmental management tools such as waste management systems and environmental impact assessment will be discussed in the context of obtaining a better and equal protection of the environment and human health at a territorial level.

Abstract Number	**P-1-32-07**
Presenter	David F Goldsmith*
Exposure	others
Health domains	respiratory disease
Type of research	review

Comparing Fracking Policies between Maryland and New York

Background: In the U.S. decisions to permit natural gas (NGF) exploration/fracking are left to each state. Both New York (NY) and Maryland (MD) have NGF moratoriums. This assessment will contrast the policies in the two states, with a focus on the role of environmental health. NGF challenges: For industry to suceed in gaining permission to initiate fracking, it will have to demonstrate capabilities to control the following--well casing/cementing so that NGF fluids do not contaminate groundwater; overtaxing local water supplies; management and disposal of fracking fluids; general emissions from trucks, noise, impacts on local roadways, farms/esidences; air quality including particulates and toxics; methane leakage; and workplace health/safety. Industry argues that it can manage these problems, though opponents are concerned about water contamination and disruption of quality of life. Industry further argues that NGF will lead to new jobs and reduced carbon footprint because natural gas will replace coal for electical power. Results: In MD, a moratorium has been in place since 2011, while in NY no drilling has been permitted since 2008. NY Dept of Conservation is awaiting a health study on water contamination, air pollution, and truck traffic, with a decision this year. In MD there is a commission studying the issue with Depts of Environment and Natural Resources. A decision is expected in 2014 and funds have been requested to study stream sampling, economic analysis, and public health. In NY locations can issue their own regulations. In MD, there is no local override. In both states, environmental health impacts are keys to acceptance of new NGF drilling. Conclusions: Although fracking has been common for decades, the risks from NGF have led to moratoriums. If industry can demonstrate that it can mitigate water contamination and reduce disruption to communites' quality of life, moratoriums might be lifted. Thus, the key in both states appears to rest on industry demonstrating reasonable control of environmental health hazards.

Abstract Number	**P-1-32-08**
Presenter	Thomas Cole-Hunter*, David Donaire-Gonzalez, Ariadna Curto, Michelle A Mendez, Judith Garcia Aymerich, Michael Jerrett, Daniel Rodriguez, Audrey de Nazelle, Mark J Nieuwenhuijsen
Exposure	no exposure
Health domains	policy
Type of research	cross-sectional study

Determinants of bicycle commuting propensity: findings from a questionnaire-based investigation in Barcelona, Spain

Introduction: Bicycle commuting is being encouraged within cities to address physical inactivity, vehicle congestion and climate change; however, certain determinants (or barriers and motivators) may exist which will affect bicycle commuting propensity. Aims: The current study (of the TAPAS project) aimed to ascertain which factors, both psychological (mental) and physical (practical), were acting as the greatest determinants for bicycle commuting propensity of the working (or studying) population of Barcelona, Spain. Methods: Adults [N=795; 51% female, 87% nationals. Mean ± standard deviation: age = 37 ± 10, body mass index = 23.5 ± 3.3] who commuted to work or school in Barcelona responded to a comprehensive questionnaire (via telephone) concerning their commute activity and attitude. Respondents were categorised as either frequent or infrequent cyclists, or willing or unwilling non-cyclists, with self-reported data analysed via binomial logistical regression models adjusted for confounders of age, gender, nationality and education level. Results: The greatest psychological barriers to bicycle commuting participation of non-cyclists were the risk of suffering an accident [OR (95% CI) = 0.67 (0.49, 0.91)] and the difficulty to maintain personal appearance [0.63 (0.44, 0.88)], while increased availability of bicycle lanes [1.64(1.18, 2.29)] and bicycle parking infrastructure [1.59 (1.12, 2.25)] were the greatest physical motivators. Further, the greatest physical determinants of bicycle commuting frequency for cyclists were the difficulty of transporting objects [0.51 (0.28, 0.90)] and the flexibility and freedom [1.50 (1.27, 1.95)] using a bicycle compared to other modes. Conclusion: To facilitate an increase in bicycle commuting propensity, infrastructure (such as dedicated bicycle lanes for safer commute conditions) and end-of-trip facilities (such as bicycle parking and locker rooms for efficient workplace integration) for bicycle commuters need to be properly considered and further developed by policy-makers and authorities.

Abstract Number	**P-1-32-09**
Presenter	Jong-Han Leem*, Hwan-Cheol Kim, Ji Young Woolee
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Effect of Improving Air Quality in Seoul Metropolitan Area in 2024 By Health Risk Analysis

Background & Aims: The Government had devised legislation of Special Act and drew up guidelines for improving air quality in Seoul Metropolitan area. 2nd plan for improving air quality in a metropolitan area will be enforced from 2015 to 2024 . During 2nd plan, health risk analysis will be carried out to make sure that air quality has been improved to protect people's health. Method: This study followed comparative risk assessment (CRA) methodology developed by EPA and the World Heath Organization (WHO). Annual mean concentrations of particulate matter (PM) with diameters less than 10 µm (PM10) and PM with diameters less than 2.5 µm (PM2.5) are assessed from monitoring network data, CMAQ, and geographic information system(GIS). Population-attributable fractions using risk coefficients presented in EPA , WHO , and Korean study were calculated , and applied to revised estimates of deaths and morbidities for Seoul metropolitan area in 2024. Conclusions: If target goal for air quality is achieved in 2024, excess death will be decreased from 19,958 cases to 4,963 cases. (-75.2%). Hospitalization for respiratory disease will be decreased from 4,714 to 1,276 (-73.0%). Chronic bronchitis will be decreased from 6,743 cases to 1,799 cases (-73.4%). Acute bronchitis will be decreased from 804,373 cases to 387,751 cases (-52.8%) for Seoul metropolitan area in 2024. Recommendation: Air quality management will be based on health risk Assessment. Health risk assessment of ambient air should be performed every 3 years at each city.

Abstract Number	**P-1-32-10**
Presenter	Henk Bouwman*, Ming Hung Wong, Ricardo Barra, Lev Neretin, Christine Wellington-Moore, Margarita Dyubanova
Exposure	others
Health domains	policy
Type of research	review

Emerging Chemical Management Issues: Prioritization of ECMIs for developing countries and countries with economies in transition

The last two decades has seen the implementation of a number of regional and international agreements regarding chemicals management. At the same time rapid globalization and demand for products, increased trade, expansion of manufacturing into Developing Countries and Countries with Economies in Transition (CEIT), new chemicals, uses, or products, coincided with an increased awareness of real or potential negative impacts. This report for the Global Environment Facility identified, evaluated and prioritized ECMIs in relation to the likely chemical management needs of Developing Countries and CEIT for possible further action. An ECMI is defined as any potential or recognized human health and/or environmental effects concern associated with chemical(s) whose management is not or only partially addressed by existing MEAs. Twenty-two ECMIs were identified, evaluated (including impacts on human health), and prioritised by 135 scientists from Developing Countries and CEIT. The ECMIs were PAHs, Arsenic, Bisphenol A, Alkylphenols, Phthalates, Organotins, Heavy metals, Nanoparticles and nanomaterials, Lead in paints, Inorganic fertilizer, Cadmium in fertilizer, Pharmaceuticals and personal care products, Illicit drugs, Food additives, Endocrine disruption, Mixture effects, E-waste, Marine debris, Ammunition, conflict and the legacies of war, Mine waste and drainage, Sewage, and Open burning. Heavy metals was the top priority, followed by PAHs, Mixture effects, Open burning, Endocrine disruption, and Sewage. We found that the scope and extent of some or most ECMIs are increasing, resulting in more pressures on human health and environment. ECMIs, if not addressed timely and adequately, will increasingly become a drag on social wellbeing and stability, environmental sustainability, and economic progress. A detailed assessment of each of the highest-ranked ECMIs should be conducted on a global and regional basis to better investigate conditions, intervention options, interactions with other ECMIs, global environmental and health benefits, and management options.

Abstract Number	**P-1-32-11**
Presenter	Liliana Cori*, Sabina De Rosis, Fabrizio Bianchi
Exposure	others
Health domains	policy
Type of research	review

Epidemiology to bridge science and policy in areas with environmental pressures

Background Policy-making in environment and health, E&H, is a complicated process due in part to the wide range of topics and uncertainty in the scientific results. Epidemiology, with it specific status of observational science, has the possibility to take into account stakeholder perspectives, and produces knowledge to be used in policy making. It is especially true when "facts are uncertain, values in dispute, stakes high and decisions urgent", as it happens in areas with environmental pressures. Era-Envhealth project (FP7-ENV-2007-CSA-1.2.3-01) tackled the issue in a multi-disciplinary perspective. Aims To develop strategies that can help researchers, programme managers, policy-makers and other stakeholders create more interdependence, understanding the uptake mechanisms of scientific information into policy in specific E&H settings. Methods Review of scientific literature, communication strategies and tools, analysis of case studies and interviews to involved actors. Results To facilitate the understanding of the contextual elements and their influence, a framework to read possible interaction flows among stakeholders and a check-list of actions to positively bridge science and policy was produced. Specific issue are crucial to understand potential conflicts, like trust, and the role of actors.The competence of knowledge broker can be also involved, to facilitate processes and co-ordination of expertise, roles and responsibilities. Conclusions It is possible to bridge science and decision-making, involving relevant stakeholders in a transparent way. Several tools and experiences are available, as well as new competences like the knowledge broker. It is desirable that those instruments will be more and more included in epidemiological research, especially when controversial issues are under examination and urgent public policies have to be implemented.

Abstract Number	**P-1-32-12**
Presenter	Alexandra Macmillan*, Michael Davies, Alistair Woodward, Jennie Connor, David Rees, Karen Witten, Robin Kearns, Clive Shrubsole, Neil May
Exposure	others
Health domains	other
Type of research	health impact assessment

From environmental epidemiology to action for climate and health: the potential of participatory system dynamics modelling

New decision-making processes and methods for translating environmental epidemiology into action are required to achieve policies that maximise the co-benefits of climate mitigation policies for health, equity and sustainability, while minimising the unintended harms. Researchers across disciplines have been converging on a set of methodological principles to promote effective policy in relevant complex systems such as urban planning, housing and transport. These principles can be summarised as involving: a systems approach; transdisciplinarity (integrating knowledge for decision making across policy, community and the academic literature); community participation in the characterisation of problems and the identification and implementation of solutions; social justice and environmental sustainability goals. System dynamics (SD) modelling used to support a group learning process has the potential to meet the principles described above. Since its inception, SD modelling has been recognised as a powerful tool for improving democratic decision-making at a range of geographical scales, from the local to the global. SD modellers involved in issues of environmental sustainability have also recognised that successful policy modelling requires input from a wide range of stakeholders, using participatory processes to build a shared understanding about the way complex systems work and explore the dynamic future effects of specific policies on a range of integrated outcomes. We share our early experiences of using participatory SD modelling, supported by epidemiology, to improve transport and housing policies. Our experiences in housing and transport indicate participatory SD modelling is promising for turning unintended consequences of into co-benefits and explicit trade-offs. We have identified some critical factors for its successful use: high level policy support; a champion within the policy agency; the involvement of influential community representatives; and timeliness of the process within the policy cycle.

Abstract Number	**P-1-32-13**
Presenter	Ying-Ying Meng*, Michael Jerrett, Jason Su, Melissa Pickett, Edmund Seto, Beate Ritz
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Improvements in Air Quality Due to Goods Movement Policies in California

In 2006, the California Air Resources Board (CARB) and local air quality management districts approved an Emission Reduction Plan for Ports and Goods Movement. The Plan proposed to reduce statewide emissions due to goods movement to 2001 levels or lower by 2010 and included strategies to help regions meet these standards. This project examines improvements in air quality due to the goods movement emissions reduction policy. Specifically, we hypothesized that goods movement corridors (GMCs) experienced greater reductions in nitrogen oxides (NOX) between pre-policy (2003-2007) and post-policy (2008-2012) intervention years compared to non-goods movement corridors (NGMCs) and controls (CTRLs). We defined GMCs as port areas or places within 500 m of truck permitted freeways or Class I railways. We defined NGMCs as locations within 500 m of truck prohibited freeways or 300 m of a connecting roadway with 4+ driving lanes. Areas outside GMCs and NGMCs served as background CTRLs. We deployed monitors at 71 sites in Los Angeles County and 49 sites in Alameda County. Using linear mixed models, we analyzed Ogawa concentration differences between 2006 and 2012 and between GMCs and NGMCs or CTRLs and tested interactions between year and category. Concentrations of NOX, nitric oxide (NO) and nitrogen dioxide (NO2) in GMCs were higher than in the other two locations ($p<0.01$).Overall, 2012 pollutant concentrations were lower than 2006 concentrations ($p<0.001$). Interaction terms showed greater reductions of NO and NOX concentrations between 2006 and 2012 in GMCs ($p<0.05$), but not in NGMCs, compared to controls. These findings indicate pollutant reductions of NOX in GMCs were greater than in other non-goods movement locations, supporting the feasibility of future studies to examine subsequent improvements in health outcomes that may have resulted from exposure reductions.

Abstract Number	**P-1-32-14**
Presenter	Scott Hanson-Easey*, Peng Bi
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	others

Making sense of climate change exposure and risk in South Australia: A case study of public construals.

Anthropogenic climate change will have multiple adverse implications for South Australia, including rising sea levels, extreme heat events, and reduced rainfall (CSIRO-BoM, 2007, 2011; DCCEE, 2011). In particular, over the next decade, heat-related deaths are projected to double (McMichael et al., 2002), and extended dry periods will place further pressure on the already struggling Murray-Darling basin, an important resource of drinking water for South Australians (DCCEE, 2011). It is now generally accepted as imperative in research and policy domains that climate change exposure and adaptation information be promulgated in forms that galvanise communities into action. Curiously, however, a paucity of qualitative empirical work in Australia has explored the sense-making practices invoked by publics when appraising and rationalising their own exposure to a changing climate. This socio-psychological study, employing a mixed-methods approach, examines lay individuals' construals of climate change. We show how social actors variably 'frame' climate change by invoking common sense understandings, values, material contexts, and perceptions and experiences of local weather and geography. As a function of this framing, climate change risk is codified relative to social and material imperatives. We argue that a nuanced understanding of climate change vulnerability and resilience involves an integration of local forms of knowledge with more formal analyses of exposure. We suggest that policy initiatives, and scientific communication strategies, would benefit from employing salient local discourses and contextual contingencies to effectively engage communities, whilst augmenting current adaptation knowledge and capacity.

Abstract Number	**P-1-32-16**
Presenter	Mae Woods*, Rebecca Close, Mike Studden, Helen Crabbe, Giovanni Leonardi, Zaid Chalabi
Exposure	others
Health domains	policy
Type of research	others

MODELLING RISK FOR PRIORITISATION OF INTERVENTIONS FOR ENVIRONMENTAL HAZARDS TO HUMAN HEALTH USING MULTI CRITERIA DECISION ANALYSIS

Background The range and complexity of environmental hazards to which populations are exposed is vast and environmental effects on health are multi-faceted. In order to capture potential hazards in a meaningful way, in which they can be compared and matched to exposures and health outcomes, there is a need for a systematic approach to enable ranking to enable scarce resources to be applied to the most significant burden of disease. Aim To develop a systematic, quantitative risk assessment methodology for identification and prioritisation of environmental hazards to human health to inform epidemiological studies. Methods 1. Design and application of preliminary study questionnaire to measure variation across a defined group and its individual members 2. Application of a questionnaire 3. Evaluation of results using the Kendall Tau test to analyse variation in individual rankings. Results The survey of a sample of trainee medical doctors (n= 22) showed a statistically significant variation in individual and combined ranking of 14 significant environmental hazards. Conclusions Qualitative assessment is distorted by biases related to wider knowledge of risk assessors, their personal experience of hazards and lack of substantive evidence of quantification and effect requiring systematic, quantative and transparent methodologies to validate consistency of risk assessment.

Abstract Number	**P-1-32-17**
Presenter	Jouni T. Tuomisto*, Sandra Torras Ortiz, Marjo Niittynen
Exposure	climate change (temperature)
Health domains	policy
Type of research	health impact assessment

Online energy balance tool to assess health impacts of climate policies in cities - case EU (Kuopio, Stuttgart) and China (Suzhou)

Background. Climate mitigation policies in municipalities have global impacts on climate change, but the actual impacts on the municipalities themselves are other than climate. Typically, energy policies may add or reduce fine particle emissions and thus cardiopulmonary effects; traffic policies affect e.g. urban sprawl, accidents, and well-being. As a part of climate policy support, there is a need for simple online impact models including energy and health. Aims. We developed an online computational model for estimating energy balance (inputs and outputs of energy on municipality level) and related emissions. The model was designed to be both a modelling and dissemination tool, and able to be updated and run by municipality authorities or even by interested citizens. Methods. We decided to use matrix calculation as the core of the tool, as we need a straightforward way to calculate a new solution when some inputs or outputs are changed by a user. The model was implemented in an open web workspace Opasnet http://en.opasnet.org/w/Energy_balance with R software. The structure of the balance table was taken from the OECD energy balance sheets, with city-specific modifications when needed. Results. Data was collected and model adjusted for two European cities: Kuopio (100000 inhabitants, in Finland) and Stuttgart (600000 inhabitants, in Germany) and one Chinese city Suzhou (2.38 million inhabitants). For example, the household electricity consumption was 296, 1077, and 625 GWh per year in Kuopio, Stuttgart, and Suzhou, respectively. The respective numbers for industry were 204, 2257, and 7032 GWh per year, showing large variation by city and by sector. Conclusions. The energy balance model works as intended and is able to calculate input/output balances for different scenarios. The next steps are to connect the model to emission models, to develop multi-city capabilities, and to improve user-friendliness.

Abstract Number	**P-1-32-18**
Presenter	Maya Negev*, Nadav Davidovitch
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Rethinking the relationship between expert and local knowledge: Toward a multi-type approach

Background: In the environmental health policy-making world of today, the knowledge that serves as a basis for decisions is for the most part expert knowledge held by experts, such as toxicologists and epidemiologists, while local knowledge held by non experts is regarded as its irrelevant opposite. Yet a growing trend among scholars and practitioners questions this approach, for example in the case of health impact assessment (HIA), which values the contribution of local knowledge. Aims: Map different types of knowledge in an HIA stakeholder participation process. portray the multilayered character of the relationship between them. Methods: participant observation of stakeholder participation in HIA. The HIA focused on land usages in the vicinity of a hazardous industry site. Qualitative analysis of 3 observations, 27 interviews, 6 focus groups. Results: The results reaffirm the assumption that the dichotomy between expert and local knowledge, and between those who hold each of them, is artificial. The stakeholders who participated in the HIA held many types of knowledge. Expert knowledge and the methods of acquiring it were not free from ambiguity, uncertainty, and controversy. Its objectivity, sufficiency & truthfulness are questioned. Local knowledge-holders knew about various health hazards, health circumstances & disease trends which were not known to experts. Moreover, each stakeholder held multiple types of knowledge. Finally, the analysis reveals that the expert-local dichotomy serves the existing power relations and creates barriers for meaningful public engagement. Conclusions: This study does not aim to disregard expert knowledge and its value for HIA. Yet, it suggests a more reflexive approach when considering its objectivity, especially in conditions of uncertainty and contested science. Local knowledge has significant contributions to HIA, albeit having its own disadvantages. It provides data on health conditions which is important especially in conditions of limited resources that characterize HIA.

Abstract Number	**P-1-32-19**
Presenter	Li Yanli, Matthew Bonner, Richard Browne, Furong Deng, Junfeng Zhang, Jicheng Gong, Kate Rittenhouse-Olson, Jingjing Yin, Lili Tian, Lina Mu*
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Serum Chemokines and Changes in Air Pollution Levels during the Beijing Olympics

Background: Chemokines are implicated as inflammatory mediators through which air pollution induces adverse health effects, however human evidence is lacking. Temporary air quality control measures during Beijing Olympics led to drastic decline in air pollution levels, and elevated to the usual levels after the Games. Aims: Our study aims to explore relationships between changes in air pollution levels and selected chemokines in human sera. Methods: We conducted a panel study in which serum samples were collected in pre-, during and post-Olympic periods from 104 healthy Beijing adults. We measured a suite of chemokines including CXCL-1 (GRO-α), CXCL-8 (IL-8), CXCL-10 (IP-10), CCL-2 (MCP-1), CCL-5 (RANTES), CCL-8 (MCP-2), CCL-11 (eotaxin) and CCL-17 (TARC) using Q-Plex Arrays multiplexed ELISA. We used linear mixed-effect models to evaluate changes in chemokine levels in relation to air pollution levels. Results: Air pollution levels during Beijing Olympics decreased by 50-60% and returned to the usual levels after the Games. CCL-5, CCL-8 and CCL-17 decreased by 25.84%, 20.88% and 35.30% respectively ($P<0.0001$) from pre- to during-Olympic period and then increased by 45.84%, 34.92% and 61.53% respectively ($P<0.0001$) after the Olympics. The changes in chemokine levels by period remained significant in subgroup analyses stratified by gender, age (≤40, 40-50, >50 years), smoking status and body mass index categories (<24, 24-28, >28 kg/m2). Significant decreases in CXCL-1 and CXCL-8 were found from pre- to during Olympics, but their levels increased non-significantly after the Games. For CCL-11, non-significant decrease was found from the pre- to during-Olympics, while significant increase was found from during to post-Olympics. Conclusion: Our panel study is among the first human studies, to our knowledge, that observed significant changes in serum chemokine concentration in response to a temporary air pollution intervention. Chemokines may act as important mediators in the inflammatory pathway induced by air pollution.

Abstract Number	**P-1-32-20**
Presenter	Paula Johnson*, Patrice Sutton, Dylan Atchley, Erica Koustas, Juleen Lam, Saunak Sen, Karen Robinson, Daniel Axelrad, Tracey Woodruff
Exposure	persistent organic pollutants
Health domains	policy
Type of research	meta-analysis

The Navigation Guide - Evidence-Based Medicine Meets Environmental Health: PFOA and Fetal Growth

Background Evaluating environmental health literature and determining the weight of evidence are critical for informing health and policy recommendations. The Navigation Guide was developed through a collaboration of 22 clinicians and scientists to improve methods of research synthesis in environmental health. This innovative systematic and transparent approach is modeled after best practices in evidence-based medicine but accounts for the differences in the evidence and decision context of environmental health. Aim To establish proof of concept of the Navigation Guide methodology to answer the question: Does developmental exposure to perfluorooctanoic acid (PFOA) affect fetal growth in humans? Methods Following a specific case study protocol, relevant studies were retrieved from several key databases and screened using exclusion criteria. Study quality was assessed using a tool based on established clinical medicine quality and risk of bias tools. Continuous effect estimates from a subset of studies (n=9) were synthesized by meta-analysis and heterogeneity among studies was assessed. The strength/certainty of the evidence was assessed using newly adapted criteria. Results We identified 18 relevant human studies. The quality rating for the body of evidence was “moderate” quality. The meta-analysis predicted that for every ng/mL increase in serum PFOA there was an 18.868 g [95% CI: -29.808, -7.928] reduction in birth weight. There were also decrements in length, ponderal index and head circumference. Key assumptions and decisions were clearly and transparently documented. Conclusions This case study demonstrates that the Navigation Guide can be used to apply the rigor of systematic review methodology to questions in environmental health. The adoption of an efficient systematic and transparent method will speed the incorporation of research into decision-making and action to prevent harm.

Abstract Number	**P-1-32-21**
Presenter	Kelin Li*, Xiaofeng Li
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	others

The relationship of Ventilation rate and pollution concentration in typical offices in Beijing

With the rapid development of economy and social progress, people now are faced with a long-standing problem, which is that indoor air pollution has become a major threat to people’ s health, and such a problem is worsening as urbanization process in China accelerates. Certain attention has been paid to the air quality to people’s homes. However, health effect due to indoor air pollution in offices in China has rarely been studied, where people stayed for almost equal amount of time. In order to improve indoor air quality and ameliorate people’s health condition, ventilation has long been seen as an effective approach, yet the quantitative relation between pollution concentration and ventilation rates in normally Chinese office is not well defined. This paper tries to solve the problem by focusing on a typical office in Beijing, by which we mean the characteristics of room structure and furniture, such as number of inhabitants and furniture’s type, condition and quantities, will be the same as those of most offices in Beijing. We will then carefully measure VOCs, CO2 as we change ventilation rate. After that, a correlation equation will be established to assess the relationship of ventilation rate and pollution concentration.

Abstract Number	**P-1-32-22**
Presenter	Josef Cyrys*, Stefanie Lanzinger, Regina Rückerl, Susanne Breitner, Alexandra Schneider, Annette Peters, Susanne Bastian, Dörte Pippel
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

UFIREG project: Ultrafine Particles – an evidence based contribution to the development of regional and European environmental and health policy

Background: There is still a need for appropriate measuring instrumentation for ultrafine particles (UFP) and their routinely application in air quality monitoring networks, especially in urban areas across European countries. Aims: Within the framework of the UFIREG project, measurements of UFP are currently conducted in five European cities: Dresden and Augsburg (Germany), Prague (Czech Republic), Ljubljana (Slovenia), and Chernivtsi (Ukraine). The specific objectives of the project are: (a) to prepare a cost-efficient UFP measurement strategy applicable in all European regions and (b) to investigate the short-term effects of size-fractioned UFP on mortality and morbidity in the five cities. Methods: UFP measurements within UFIREG are performed using Differential or Scanning Mobility Particle Sizer. In addition, two Ultrafine Particle Monitors, recently developed within the former EU project UFIPOLNET (Ultrafine particle size distributions in air pollution monitoring networks), are operated in Prague and Augsburg. An extensive quality assurance program is an essential part of UFIREG comprising staff training, an initial intercomparison of the instruments and frequent on-site comparisons against reference instruments. Results: Preliminary results of 2012 indicate no large differences between annual averages of UFP in the size range between 20 and 200 nm at all stations (except Chernivtsi). The annual means range between 6.000 and 6.500 particles per cm^3. However, more pronounced differences were observed for weekly and monthly variation of UFP. Conclusions: On the basis of the measured air quality data, epidemiological studies will be carried out in all participating cities. These studies shall contribute to the environmental policy in Europe and concrete local measures by developing differentiated solutions to the respective regional settings.Therefore, the results will be passed on to local and national policy makers, environmental and health authorities, health insurance providers, as well as city citizens.

Abstract Number	**P-1-32-23**
Presenter	Nicolle S. Tulve*, Marian Olsen, Michael Broder
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	others

Update to the U.S. EPA's Guidelines for Human Exposure Assessment

The mission of the U.S. EPA is to protect human health and the environment by understanding, characterizing, and reducing health risks associated with exposure to environmental contaminants. Exposure science characterizes, estimates, and predicts exposures and provides information for developing exposure and risk assessments as well as effective strategies for reducing exposure and risk. When conducting a risk assessment, an assessor needs to understand whether an agent may cause an adverse health effect and how exposure to that agent may be reduced. Advances in the field of exposure science require updated resources for conducting exposure and risk assessments. The Guidelines for Human Exposure Assessment has been prepared to provide an updated resource for exposure and risk assessors both within and outside the Agency. This document builds on the 1992 Guidelines, incorporating advances in the field that have occurred since the Guidelines were originally published. It reflects the best science currently conducted across the Agency. This updated document describes the principles of exposure assessment, provides guidance on approaches to conduct an exposure assessment, presents references for more detailed information, and supplies hyperlinks to exposure assessment tools and technical documents found in the text. The Guidelines are arranged into chapters, each of which explores a component of the exposure assessment process, including: basic concepts and principles in exposure science; planning and scoping; incorporating lifestages, vulnerable groups, and populations of concern into an assessment; collecting and using data; using models; planning an observational exposure measurement study; evaluating uncertainty and variability; and presenting and communicating results. This presentation will highlight and showcase many of the updates in the document.

Abstract Number	**P-1-33-01**
Presenter	Hendrik Modick*, Andre Schutze, Claudia Pälmke, Tobias Weiß, Thomas Brüning, Holger M. Koch
Exposure	others
Health domains	reproductive outcomes
Type of research	exposure measurement

Human-Biomonitoring of N-acetyl-4-aminophenol (paracetamol/acetaminophen) - the major metabolite of aniline

Aniline is an important building-block in several industrial processes (e.g. rubber, colorants, pesticides and pharmaceuticals). Exposure to aniline is therefore both of occupational and environmental relevance and the general population is known to be ubiquitously exposed to aniline. N-acetyl-4-aminophenol (NAAP) is the major urinary metabolite of aniline representing 56%-76% of the dose. Furthermore, NAAP, also known under the trade names acetaminophen/paracetamol, is one of the most commonly used over-the-counter analgesics. Recent epidemiological studies suggest that intrauterine exposure to NAAP is a risk factor for the development of male reproductive disorders. Human biomonitoring data on the body burden of the general population (and potentially exposed subpopulations) to NAAP is literally nonexistent. To determine the internal NAAP exposure of the general population, workers exposed to aniline and users of acetaminophen, we developed a fast on-line HPLC-MS/MS-method with isotope dilution quantification of NAAP in urine with a limit of quantification (LOQ) of 0.75 µg/L. In a pilot study, urine samples of 21 volunteers, not occupationally exposed to aniline, were analyzed for NAAP. NAAP was detected in all samples in a wide concentration range between 8.7 µg/L and 22100 µg/L (median 85.7 µg/L). The highest concentration was measured in a volunteer who took acetaminophen approximately a day ago. Half of the volunteers quoted to either never have taken acetaminophen or not during the several weeks before sampling. Therefore, other routes of exposure than direct use of acetaminophen, like aniline exposure or acetaminophen contaminated foodstuff, leading to the NAAP excretions have to be taken into account.

Abstract Number	**P-1-33-02**
Presenter	Yohannes A. Melaku*, Hailemariam Reda
Exposure	others
Health domains	reproductive outcomes
Type of research	cross-sectional study

Parent and Peer Communications on Sexual and Reproductive Health Issues are Independently Associated with Contraceptive Method Awareness of Female Students

Background It is estimated that 11% births globally are given by adolescent girls of age 15-19 annually, and 95% of the births are in low income countries. Awareness about methods of contraception is an important step towards gaining access to and using a suitable contraceptive method in a timely and effective manner. Aims To assess the effect of parent and peer communication about sexual and reproductive health issues on awareness of contraceptive methods among secondary school female students Methods A cross sectional study was conducted among 807 female students in six secondary schools in the Northern Ethiopia, Mekelle town in 2012 using structured self administered questionnaire.The data were entered in to computer by EPI Info Version 3.3.2 software and were analyzed by SPSS version 20 software. Bivariate and multivariate logistic regression analyses were used to identified predictors. Results A total of 807 female students were included in the study with 100% response rate. About 15.7% (n=127) of students ever had sex.Of which, 85.8% (n=130) of the students ever used contraceptives.About 88% (n=716) of female students had awareness about contraceptive methods. Discussing about sexual and reproductive health issues with parents [AOR =2.49(95% CI: 1.41, 4.40)] and peers [AOR=2.39(95% CI: 1.45, 3.93)], being senior school student [AOR=1.94 (95% CI: 1.00, 3.79)] and ever had sex [AOR=8.95(95% CI: 2.04, 39.23)] were found to be independent predictors to awareness of students about contraceptive methods. Conclusions Discussing on sexual and reproductive health issue with family and peers positively affect awareness of students on contraceptive methods. Therefore, strategies to escalate open parent and peers communication on sexual and reproductive health should be established. Key words Secondary school, parent communication, peer communication, Sexual and reproductive health, contraceptive methods.

Abstract Number	**P-1-33-03**
Presenter	Jacqueline Moya*, Linda Phillips
Exposure	others
Health domains	reproductive outcomes
Type of research	review

Physiological and Behavioral Changes in Pregnant and Lactating Women and Relevant Data on Exposure Factors

There are many physiological, anatomical, and behavioral changes that occur in a woman's organ systems during the course of pregnancy and lactation. As a result, pregnant and lactating women may experience environmental exposures that may be different from those of other women in the general population. These exposures may have an impact on the health of the mother, the developing fetus, the child, or the adult later in life. Assessing risks to this potentially susceptible population requires an understanding of the physiological and behavioral changes that occur during pregnancy and lactation and the related exposure factors and how they may differ from women in the general population. For example, a woman's nutritional needs are greater during pregnancy and lactation to meet the demands of the developing fetus and infant. Water consumption also increases during pregnancy and lactation. This presentation provides a summary of the published information on behavioral and physiological differences in pregnant and lactating women that may alter their exposure to environmental contaminants, provides available exposure factor data for this population of women, and highlights data gaps.

Abstract Number	**P-1-33-04**
Presenter	Pinaki Panigrahi*, Bijaya Kumar Padhi, Leslie Elliott
Exposure	others
Health domains	other
Type of research	health impact assessment

Prevalence and determinants of low birth weight and prematurity among rural, urban, and indigenous tribal communities in India.

Background: Birth weight and gestational age are important determinants of child survival and development. Developing countries like India have been recording very high prevalence (30-40%) of low birth weight (LBW) and a relatively low prevalence of prematurity (~10%). Aim: Examine the role of multiple environmental factors on neonatal outcomes in India. Methods: Utilizing a population-based, 6884 mother-baby cohort spread across rural, tribal, and urban areas of Odisha, we have recently launched the IMMENSE (Impact of Maternal Environmental and Socio Economic - status on child health and development) study where data are being collected on maternal variables and on type of household cooking fuel, direct smoke and ETS, drinking water, alcohol use, and exposure to occupational/industrial/ and mining and pesticides and fertilizers, New births are also being added to this cohort. Results: Average gestational age in this population was 32 weeks and birth weight was 2.53 kg. A total of 28% babies were premature; 13.3% ≤ 35 weeks, and an additional 14.8% between 36-40 weeks of gestation. The decrements in birth weight were attenuated using multivariate analyses after adjusting the maternal and socioeconomic factors. The environmental factors significantly associated with LBW were biomass fuel/household air pollution (OR-2.51), drinking water (OR-2.34), proximity to industry/highway (OR-1.98), domestic/agricultural pesticide use (OR-1.91), smoking/ETS (OR-1.85), and alcohol use (OR-1.39). Although small in number, newborns in households using liquid petroleum gas did not seem to have better outcomes. Conclusions: This study demonstrates an unexpected shift from low birth weight preponderance to an increase in prematurity in India (similar to the western countries). While improved maternal health over the decades might have contributed to reduction in LBW, new and significant environmental pollution may be contributing to preterm births. The IMMENSE study was funded by a grant from the University of Nebraska Foundation.

Abstract Number	**P-1-33-05**
Presenter	Annabel Rigou*, Jean-Claude Carel, Juliane Léger, Alain Le Tertre, Joëlle Le Moal
Exposure	no exposure
Health domains	reproductive outcomes
Type of research	others

Temporal and spatial trends of precocious puberty in France: a feasibility study

Background Precocious puberty (PP) is defined as the development of secondary sexual characteristics before the age of 8 in girls and 9 yrs in boys. The prevalence is about 10 times higher in girls than in boys. The disease is mostly due to the activation of the pituitary-gonadal axis (central PP) with no identified cause. Early environmental exposure to endocrine disruptors (ED) seems to impair sexual development and could play a causal role. Female PP incidence is suspected to have increased in some countries. Very few studies have been published on the incidence of PP at the scale of a whole country. Therefore a better knowledge on the epidemiology of PP is needed. Aims The objective of this study was to assess the feasibility of monitoring trends of PP in France based on medical-administrative databases. Methods To establish the diagnosis of PP, patients are mostly evaluated in day hospital. We counted all first hospital admissions related to PP (considered as a proxy of clinical suspicions of PP) between 2002 and 2011 based on data available from the French National Hospital Discharge Database. Cases were selected according to age, sex, and diagnosis. Zip code was available, thus allowing geographical distribution of cases to be studied. In addition we looked at the number of children actually treated for PP by GnRH analogs between 2010 and 2013, based on exhaustive data obtained from the French National Information System for Health Insurance. Zip code was also available. We analysed temporal and spatial trends based on these two indicators. Results We estimated incidence rates and temporal trends for clinical suspicions and geographic disparities for clinical suspicions and treated PP. We observed marked geographical disparities. Conclusions This is the first study describing trends based on PP evaluation and treatments at the scale of a whole country. Interpretation of the results needs to focus on several limits, such as temporal and geographical differences in medical practices regarding PP definition, evaluation and management.

Abstract Number	**P-1-33-06**
Presenter	Mary Mortensen*, Antonia M. Calafat, Xiaoyun Ye, Lee-Yang Wong, David Wright, James Pirkle, Lori Merrill, Michael Dellarco, John Moye
Exposure	others
Health domains	reproductive outcomes
Type of research	cross-sectional study

Urinary Concentrations of Environmental Phenols in Pregnant Women in the National Children's Study

Background: Environmental phenols are a group of chemicals with widespread uses in consumer and personal care products, food and beverage processing, and in pesticides. Aims: We assessed exposure to benzophenone-3, bisphenol A (BPA), triclosan, methyl- and propyl parabens, and 2,4- and 2,5-dichlorophenols or their precursors in 506 pregnant women enrolled in 2009-2010 in the National Children’s Study (NCS) Vanguard Study. Methods: We measured the urinary concentrations of the target phenols by using online solid-phase extraction–isotope dilution high performance liquid chromatography-tandem mass spectrometry. We compared 506 NCS women’s results to those of 524 similar-aged women in the National Health and Nutrition Examination Survey (NHANES) 2009–2010, and also to 174 pregnant women in NHANES 2005–2010. Results: In the NCS women, we found significant racial/ethnic differences ($p<0.05$) in regression adjusted mean concentrations of benzophenone-3, triclosan, 2,4- and 2,5-dichlorophenols, but not of BPA. Urinary 2,4-and 2,5-dichlorophenols concentrations were highly correlated ($r=0.66$, $p<0.0001$). Except for BPA and triclosan, adjusted mean concentrations differed significantly across the 7 study sites. Maternal age (16-29 vs. 30-44) and annual family income were not significant covariates for any of the urinary concentrations of the phenols. Education was marginally significant for benzophenone-3, triclosan, propyl paraben, and 2,5-dichlorophenol. Urinary phenols concentrations were generally similar in pregnant NCS and NHANES women. Conclusions: In NCS pregnant women, race/ethnicity and geographic location determined urinary concentrations of most phenols (except BPA), suggesting differential exposures. NCS Main Study protocols should collect similar biospecimens as well as information about specific exposures to environmental phenols.

Abstract Number	**P-1-33-07**
Presenter	Caterina Ledda*, Margherita Ferrante, Alfredo Busà, Maria Fiore, Placido D'Agati, Chiara Copat, Roberto Fallico, Elena Proietti, Venerando Rapisarda
Exposure	pesticides
Health domains	cardiovascular disease
Type of research	cohort study

Risk of hypertensive disorders and pesticide exposure during pregnancy

Background. Hypertensive disorders of pregnancy complicate 2–8% of all pregnancies. They include both pregnancy-induced hypertension (PIH) and preeclampsia (PE). PE is a major cause of maternal and perinatal morbidity and mortality, and severe PIH has been reported to have similar adverse effects. Several studies have shown an association between pesticides and hypertension in general. Aims. In this study we sought to examine the relation between pesticide exposure during pregnancy and the development of PIH and PE. Methods. We enrolled a cohort of 1902 farmers and private applicators of pesticide. All women completed a questionnaire on health status and on pesticide-related activities. 177 of 889 women were excluded for various confounding and also people who had chronic hypertension (HTN) before pregnancy. We defined four pesticide exposure categories. We estimated the odds ratios (ORs) for PIH and PE, treating the four exposure categories as a class variable. We used women with no reported exposure as the reference category. All statistical analyses were done using SPSS, version 16. Results. The proportions reporting PIH and PE were 6.4% and 5.1%, respectively. First-trimester pesticide exposure was associated with PIH and PE for chi-square tests of the overall predictive contribution of the pesticide variable for the two outcomes, having p-values of <0.05 and <0.01, respectively. The adjusted odds ratios (AORs) of the restricted analysis for pesticide exposure in relation to PIH were 1.26 (95% CI, 0.89–1.65) for residential exposure and 1.91 (95% CI, 1.11–2.84) for agricultural exposure. The corresponding ORs for pesticide exposure in relation to PE were 1.22 (95% CI, 0.83–1.77) and 2.13 (95% CI, 1.21–3.42). Conclusions. Exposure to pesticides during pregnancy may increase the risk of hypertensive disorders of pregnancy.

Abstract Number	**P-2-01-01**
Presenter	Shi Chen*, Shinsuke Kato, Yoonkyung Kang, Keisuke Nakao
Exposure	ambient air pollution
Health domains	infectious diseases
Type of research	case-control study

CFD Analysis about Influence of Human Movements on Diffusion of Indoor Air Pollutants

It has been proved that human movement plays an important role in diffusion of indoor air pollutants. A typical place of an example is the reception in hospital. This place is crowded with walking patients, doctors, and virus may be diffused. Therefore it is essential to know how human movements affect the indoor air pollutants, so that we can control the diffusion of pollutants. The main aim of our research is to evaluate the influence quantitatively with Scale for Ventilation Efficiency 2 (SVE2), which indicates the second moment of space distribution of concentration. By means of SVE2, we can evaluate the effectiveness of ventilation system. In the near future, this method would be helpful to develop better systems to deal with dynamic conditions such as human movements. As a method, we used CFD simulation to study the influence for pollutant diffusion by ventilation or human movement. First, we did a validation for the software by referring the experiment carried out by Kondo. Next, we simulated two situations including a room with ventilation, and the same room with a person doing the circular movement. The pollutants diffusion of these two situations are compared to study the influence caused by ventilation or movements. We calculated SVE2 for both situations to evaluate the influence quantitatively. The results of validation work show that in totally 6 test points, CFD results for air velocity of 4 points fit well with the experiment results. Calculation results of SVE2 show that the influence of human movements are more significant than the influence of ventilation with the same input power. It is also confirmed for the influence of movements with different types of human models, the less input power, the less influence on diffusion of pollutants. We conclude that firstly CFD method is proved to be validated. Secondly SVE2 is a proper scale to evaluate the diffusion effect of human movements or ventilations. Further study is to be carried out to continue using the scales to evaluate how ventilation systems restrain the diffusion of pollutants.

Abstract Number	**P-2-02-01**
Presenter	Victoria Likhvar*, Konstantinos Markakis, Myrto Valari, Colette Augustin, Didier Hauglustaine, Sylvia Medina, Mathilde Pascal, Patrick Kinney
Exposure	ambient air pollution
Health domains	other
Type of research	review

A review of quantitative health impact assessments of ozone and particulate matter under a changing climate

Assessing the future impacts of air pollution in a changing climate is an important input to relevant mitigation and adaptation decision making. It requires a close collaboration between epidemiologists, climate and air quality modelers. The main objective of the review was to provide an overview of the prior academic research on quantitative health impact assessment (HIA) of ozone (O3) and particulate matter (PM) under a changing climate and to explore the strengths and weaknesses of the existing approaches. From an initial set of 67 articles, we selected 23 studies which focused on: (a) the impact of different climate change scenarios on O3 or PM2.5 concentrations, (b) the quantitative predictions of total, respiratory, cardiovascular/cardiopulmonary mortality or morbidity outcomes due to predicted changes in air pollution levels; and (c) the estimates of health effects of air pollution along a range of geographical scales, from global to local. To characterize the approaches used in the reviewed literature we consider the most common requirements, such as providing the information on data on affected populations, exposures and changes to exposures, valid effect measures, models, and valid concentration–response functions (CRFs). Then, we describe examples of quantitative estimation in HIAs from a range of available air quality policy contexts. Finally, we provide several practical considerations for the use of quantitative estimations in HIA of air quality and climate change, based on our analysis of the reviewed literature. Our literature review identified very heterogeneous HIAs because of the many different environmental models, geographical scales, and time horizons utilized. Focusing on climate change alone, the majority of studies predict an increase in ozone- or PM-related deaths by the 2030s and 2050s, while some studies demonstrate the number of deaths which can be avoided globally or locally by implementing the emission reduction policies to reduce the number of days with high air pollution concentrations.

Abstract Number	**P-2-02-02**
Presenter	Olena Turos*, Arina Petrosian, Oksana Ananyeva, Ganna Davydenko
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

ADDITIONAL MORTALITY CASES ATTRIBUTED TO PM METALLURGICAL INDUSTRY EMISSIONS

Background/Aims: Numerous epidemiologic and monitoring studies prove the relationship between particulate matter air pollution (TSP, PM10, PM2,5) and adverse health outcomes including respiratory and cardio-vascular mortality. The aim of the research is to estimate additional mortality and human health risk levels predetermined by PM10 metallurgical industry emissions. Methods: Filed studies on estimation of TSP and PM10 concentrations were conducted in 12 sampling points corresponding to the location of the nearest residential area. Monitoring data was not available for this research as PM10 is not a subject of monitoring in Ukraine. Averaged 24-hour concentrations were calculated using air pollution dispersion model ISC-AERMOD v.7.5.0 (441 receptor points with 500m grid spacing, 2000 m buffer zone). Computed concentrations were compared with field data in terms of consistency. Results. According to the data obtained in field studies 24-hour concentrations for TSP and PM10 were: Cmean=340±100 mkg/m3 and Cmean=150±55 mkg/m3 correspondingly. The applied dispersion model revealed slightly different outputs: Cmean=450±190 мкг/м3 for TSP and Cmean=248±105 mkg/m3 for PM10. It was estimated that even a short-term variation in particulate matter exposure resulted in negative health effects even at levels below 100 mkg/m3. Individual mortality risk levels were estimated for PM10: IRM=1.5×10-5÷1.1×10-3. Maximum number of additional mortality cases (AM) related to particulate matter air pollution, namely to PM10, equaled 2193 cases, which corresponds to 18.7 % of the total mortality of the city. Based on the data obtained, a 10 mkg/m3 increase in PM10 concentration resulted in a 0.6-0.8 % growth in additional mortality. Conclusion. The data and results obtained in the research were taken into account while developing local environmental program for substantiation of the TSP and PM10 monitors location and working out health protection interventions for the population residing in the zones of high air pollution impact.

Abstract Number	**P-2-02-03**
Presenter	Noah Scovronick*, Daniela Franca, Ben Armstrong, Karla Longo, Zaid Chalabi, Bernardo Rudorff, Saulo Freitas, Claudia Almeida, Paul Wilkinson
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Air quality and health impacts of ethanol production and use in São Paulo State, Brazil

Background: Ethanol is receiving increasing attention as an alternative to petroleum in the transport sector. Brazil is the world's second largest ethanol producer – using sugarcane as the primary feedstock crop - and ethanol is estimated to account for over 40% of car fuel in the country. However, the impacts on air quality and health associated with ethanol production and use are still largely unexplored. Aims: We modeled the impact of two future ethanol production scenarios on air quality and health in Sao Paulo State, Brazil, from 2012-2020. Methods: The first scenario assumes that ethanol production is frozen at current levels while the second assumes that production increases according to government targets. Air quality was assessed using the CCATT-BRAMS atmospheric chemistry model and accounted for differences in emissions from two sources: sugarcane straw burning and automobile combustion. Morbidity and mortality were assessed using life-table methods and based on published relative risk estimates. Results: Preliminary analyses suggest that, due to recent legislation, pre-harvest burning of sugarcane fields will decrease over time in both future scenarios. Therefore, air quality in sugarcane areas will improve compared with historical levels and show only modest differences between the two scenarios; although an estimated 40% more burning will occur in the ethanol expansion scenario in 2020, this comprises only a fraction of the total area harvested. In terms of combustion, increased ethanol use reduces emissions of PM, but increases the production of ozone precursors. Differences in future air quality-related health impacts between the two scenarios are likely to reflect this pattern; improvements in urban areas with expanded ethanol use, accompanied by slightly higher health burdens in sugarcane growing regions. [Analyses will be complete prior to conference] Conclusion: Increased ethanol production and use will result in tradeoffs between different health-relevant air pollutants and between urban and rural health.

Abstract Number	**P-2-02-04**
Presenter	Ying Li, Daven Henze, Darby Jack, Patrick Kinney*
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Assessing the National Public Health Burden Associated with Exposure to Ambient Black Carbon in the United States

Background: Black carbon (BC) is a significant component of fine particulate matter (PM2.5) air pollution, which has been linked to a series of adverse health effects, in particular premature mortality. Recent scientific research indicates that BC also plays an important role in climate change. Therefore, controlling black carbon emissions provides a great opportunity for a double dividend. Aims: This study quantifies the national burden of mortality attributable to long-term exposure to ambient BC among adults in the United States (US). Methods: We use GEOS-Chem, a global 3-D model of atmospheric composition to estimate the 2010 annual average BC levels at a 12-km grid resolution across the continental US. Using PM2.5 mortality risk coefficient drawn from the American Cancer Society cohort study, the numbers of deaths due to BC exposure were estimated for each 12-km grid, and then aggregated to the county, state and national level. States and counties were ranked by both total number of deaths and percentage of deaths attributable to BC. Given recent evidence that BC particles may pose a greater risk on human heath than other components of PM2.5, we also conducted sensitivity analysis using BC-specific risk coefficients drawn from recent literature. Results: We estimated approximately 14,000 deaths to result from the 2010 BC levels. The total number of BC-related deaths was the greatest in the State of California, and the percentage of BC-related deaths was the greatest in the State of New Jersey. Sensitivity analysis indicates that the total BC-related mortality could be up to ten times larger than the above estimate. Conclusion: Our findings indicate that controlling BC emissions would have substantial co-benefits for public health in the US.

Abstract Number	**P-2-02-05**
Presenter	Shinji Otani*, Kazunari Onishi, Nanase Inoue, Yae Yokoyama, Haosheng Mu, Takenobu Hosoda, Mikizo Okamoto, Youichi Kurozawa
Exposure	ambient air pollution
Health domains	allergies
Type of research	health impact assessment

Associations between subjective symptoms during Asian dust events and serum immunoglobulin E levels

Background: Asian dust events result from the displacement of atmospheric pollutants from the Chinese and Mongolian deserts. These events are considered as an environmental problem arising from human activities rather than a naturally occurring seasonal phenomenon. Although Asian dust event frequencies and atmospheric dust levels have steadily increased in the eastern Asia region, the effects of Asian dust on human health are not well known. Aims: To evaluate the effects of Asian dust on human health in terms of allergic reaction, we investigated the relationship between the subjective symptoms during Asian dust events and the serum immunoglobulin E levels. Methods: Our subjects were 25 healthy volunteers from Yonago, Japan who provided informed consent. They were provided with questionnaires on nasal, pharyngeal, ocular, respiratory, and skin symptoms. Daily symptoms were recorded by self-checking visual analogue scale during the spring of 2012. We also measured serum levels of non-specific immunoglobulin E (IgE) and 33 allergen-specific IgE molecules. Furthermore, patch testing was performed for six metals and the collected dust samples to determine the total suspended particles during Asian dust days. Multiple regression analysis was used to assess the relationships between symptom scores and these allergy indicators. Results: In total, 3 Asian dust days were identified during the observation period. Symptom scores during Asian dust days were higher than during non-Asian dust days. Multiple regression analyses revealed that the nasal symptom scores were significantly associated with two specific IgE levels (cheddar cheese and milk). Skin symptom scores were significantly associated with skin reactions to the dust samples. Conclusions:Dairy products are a known cause of food allergy, a typical type I hypersensitivity reaction. Type IV hypersensitivity is associated with contact dermatitis. Some symptoms during Asian dust days may be associated with various allergic reaction types.

Abstract Number	**P-2-02-06**
Presenter	Susann Henschel*, Gabrielle Chan, Marie-Eve Héroux, Patrick G. Goodman
Exposure	ambient air pollution
Health domains	other
Type of research	others

Emerging issues on risks to health from air pollution: results from the WHO-HRAPIE survey of experts

Background: The World Health Organization (WHO) Regional Office for Europe is currently implementing project “Health Risks of Air Pollution in Europe – HRAPIE” with financial support from the European Commission. This project will provide scientific evidence-based advice on health aspects of air pollution in support of the comprehensive review of European Union’s air quality policies scheduled for 2013. As part of the project, an electronic survey tool is being developed asking questions relating to the identification of specific new emerging issues in order to answer the general question: “Is there evidence of new emerging issues on risks to health from air pollution, either related to specific source categories (e.g. transport, biomass combustion, metals industry, refineries, power production), specific gaseous pollutants or specific components of particulate matter (e.g. size-range like nano-particles and ultra-fines, raw earth metals, black carbon (EC/OC)?” Methods: This project is still ongoing. The electronic survey tool will be disseminated by WHO to key stakeholders and expert institutions with an interest in air quality issues, including ISEE members based in Europe, by Mar 2013. The online tool will be available for a limited period of time (few weeks) for input. Specific questions on the nature of the professional activity of the people surveyed, as well as other demographic questions, will be asked but answers will remain anonymous. All responses to the survey will be analyzed collectively for trends, and a report summarizing findings and discussing implications of results will be prepared by May 2013. We expect that findings collated from the survey will represent a timely evaluation of emerging issues on health risks from air pollution related to specific source categories.This will inform and provide guidance for consideration of this evidence in subsequent work on policy formulation.

Abstract Number	**P-2-02-07**
Presenter	Aymeric Bun Ung, Mathilde Pascal*, Perrine de Crouy-Chanel, Victoria Likhvar, Sylvia Medina, Christophe Declercq
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Health impact assessment of air pollution beyond urban areas: protocol for a pilot study in two French regions

Background: The effects of air pollution on health are now well documented. As the individual risk from air pollution is relatively low while the whole population is exposed, health impact assessment (HIA) helps getting a clearer vision of its public health impact. In France, HIAs of air pollution in urban areas using a standardised method developed by the French Surveillance Programme on Air Pollution and Health (PSAS) have been largely used to promote local policies. However, now stakeholders express the need for HIAs on a regional scale, beyond urban areas. Aims:The objectives of this pilot study are to test the interest and the feasibility of conducting an HIA at a regional scale in several French regions. We have identified the methodological and technical difficulties of the HIA at a regional scale and evaluated the added value of the results for stakeholders in order to extend the method to other regions. Methods: We conducted a literature review on existing studies on HIA at a regional scale. Results: Based on a literature review and experts' advice, we defined three approaches, two quantifying the current impact of air pollution according to the scenario, and one quantifying the future impact of implemented policies. The pilot study has been implemented in two contrasted French regions: Ile-de-France and Languedoc-Roussillon. It has evaluated the short-term impact of ozone and the long-term impact of PM2.5 on mortality, testing different spatial grids, from 10 kilometers in rural areas to 2 kilometers in highly urbanized areas. Conclusions: Recent developments of modeling methods on air quality and geographic information systems make HIAs feasible at a regional scale. They provide an objective spatial estimate of the impacts of improvements in air quality on a given population's health and may help decision makers in planning and implementing measures to protect public health more effectively.

Abstract Number	**P-2-02-08**
Presenter	Yorifuji Takashi*, Sanghyuk Bae, Saori Kashima, Toshihide Tsuda, Hiroyuki Doi, Yasushi Honda, Ho Kim, Yun Chul Hong
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Health Impact Assessment of PM10 and PM2.5 in 35 Southeast and East Asian cities

Background: Several collaborative air pollution studies were conducted in Western countries (e.g., Apheis, APHENA). However, similar attempts were rare in Asian countries. Aim: To assess annual health-impacts of PM10 and PM2.5 in Asian cities with population more than 1 million as well as the capitals of Southeast and East Asian countries in one year (2009). Methods: We selected 35 cities from Korea, Japan, Philippines, Singapore, and Viet Nam (No. of combined population: 54,793,747). We obtained annual concentrations of particulate matter (PM2.5, PM10, or TSP) measured at urban background stations in 2009. When PM2.5 or PM10 was not available, certain conversion factors were used to estimate PM2.5 or PM10 from other particulate matter indicators (e.g., TSP, SPM). We also obtained annual mortality among people over 30 years old due to the following reasons: total mortality, total mortality excluding external causes, cardiopulmonary mortality, and lung cancer mortality. We calculated number of long-term attributable cases assuming that there is a causal relationship between particulate matter and the observed health effects. Following the WHO Air quality guidelines, we conducted the health impact assessment for the scenario of reducing the annual mean value of PM10 and PM2.5 to the levels of 20 µg/m3 and 10µg/m3, respectively. Results: Annual mean (observed or estimated) concentrations of PM2.5 and PM10 ranged from 9.9 to 103.8 µg/m3 and 15.1 to 173.0 µg/m3, respectively. Reducing long-term exposure to PM10 and PM2.5 to the levels of above-defined values would have prevented about 40,000 early deaths in the 35 cities. Among the 40,000 early deaths, one-thirds was associated with cardiopulmonary mortality and one-eighths was associated with lung cancer mortality. Conclusion: The current air pollution levels in Southeast and East Asian countries have a non-negligible public health impact.

Abstract Number	**P-2-02-09**
Presenter	Jeni Staykova*
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

HEALTH RISK ASSESSMENT OF CHILDREN IN THE ENVIRONMENTALLY ENDANGERED AREA OF KARDZHALI FOR THE PERIOD 1991-2013

Background More than 55 years of Kardzhali is environmentally risky area in Bulgaria due to intense pollution from mining-processing, metallurgical industry and processing of non-metallic minerals. The main source of pollution in those years is OCK-AD (Lead and Zinc Complex), but from 2011 to 2012 was gradually stopped respectively lead and zinc production. One of the mechanisms to assess the health risk among the population is to conduct biological monitoring, ie making biological materials to determine the concentration of heavy metals in them. The most vulnerable group are children. Aims The aim of this study is to benchmark the results of the biological monitoring of children aged 9 to 14 years in the city of Kardzhali for the period 1991-2013. Methods Biological monitoring includes determination of lead in the blood of 356 children from two schools in the city of Kardzhali (located near and far away from OCK-AD) and one in Krumovgrad (for control). Results According to the individual results for the period 1991-2002, when OCK has worked, in 71% of the children in Kardzhali values of lead in the blood are below 100 µg / l, in 24% between 100 and 200 µg / l and in 5% over 200 µg / l. In 2013, when the company ceased operation in 92% of surveyed children the levels of lead in the blood is below 100 µg / l, in 7% from 100 to 200 µg / l and in 1% above 200 µg / l. Conclusions The results indicate a link between air pollution with lead aerosols and the level of lead in the blood of children: - In the intensive work of the plant during 1991-2002 years in 29% of children amounts of lead in the blood is above 100 µg / l; - In 2013 (when closed proceedings) only 8% of children are with lead content in the blood of more than 100 µg / l; - The blood of the children in the control group demonstrated no lead content at 100% of children.

Abstract Number	**P-2-02-10**
Presenter	Wang Xiuyan*, Yi Zhongqin, Zhang Yin
Exposure	ambient air pollution
Health domains	cancer
Type of research	health impact assessment

Health Risk Assessment of Cooking Oil Fumes in China

Abstract:With the development of eatering trad , the pollution of cooking oil fume (COF) is becoming more and more severe in china. In order to assess the COF exposure to health risk, the compositions of COF from cooking in TIANJIN .SHENYANG and BEIJING of China were investigated by using the method of GC-MS, the Lifetime Cancer Risk(LCR) and Meta-analysis method were employed. The average mass concentration of volatile organic compounds(VOCs) from cooking was 3400µg.m-3,which is 1.7 times of fine organic particle. LCR values were estimated to conduct relevant health risk assessment under the risk assessment system of EPA, there was a large potential cancer risk of 1,3-butadiene and benzene, whose LCR was respectively 1.3×10-3 and 1.6×10-5. Longtime exposure to COF will inhabit the cellular immune function. Furthermore, COF was of an important risk factor of female lung cancer. Case - control study analysis showed that cooking for the crowd of lung cancer attributed to 23.21%, second only to smoking. the crude death rate of the cooks for lung cancer was 98 per10, 000 population per year, male and female lung cancer mortality was significantly higher compared with the local residents. So COF should be payed more attention to reduce health risk.

Abstract Number	**P-2-02-11**
Presenter	Sofie De Prins*, Martine Van Poppel, Evi Dons, Luc Int Panis, Els Van de Mieroop, Bianca Cox, Tim S. Nawrot, Greet Schoeters, Gudrun Koppen
Exposure	ambient air pollution
Health domains	no health domain
Type of research	health impact assessment

HEAPS STUDY RESULTS: HEALTH EFFECTS OF AIR POLLUTION IN ANTWERP SCHOOLS

Background: Air pollution exposure has been associated with respiratory, cardiovascular, and neurological health problems. It is hypothesized that health effects mainly occur through the induction of oxidative stress. Aims: Our goal was to investigate the relation between air pollutants and biomarkers for oxidative stress and airway inflammation in primary school children. Methods: The study design is described in detail in the abstract “HEAPS study design: health effects of air pollution in Antwerp schools”. In short, 130 children from 2 schools were examined in spring and autumn of 2011. Air quality was monitored at school (UFP, PM, BC, NOx and O3 measurements) and at home (BC and NO2 based on LUR) for several short and long term exposures. Noninvasive markers for oxidative stress (8-isoprostane in exhaled breath condensate (EBC) and 8-oxodG in urine) and inflammation (FeNO, EBC pH, IL-β in EBC and IL-8, ECP, tryptase and allergic IgE responses in the nose) were analyzed. ISAAC-type questionnaires were used to assess allergic symptoms. Results: NOx, O3, PM10, PM2.5 and UFP at school the day before or the day of medical exam were associated with FeNO, EBC markers (pH and IL-1β), and 8-oxodG in urine. Exposure to NO2 and BC (modeled with LUR) up to 10 days before medical exam was related with FeNO, EBC pH and 8-oxodG in urine. Seasonal and yearly average NO2 concentrations at the home location significantly influenced nasal tryptase. GIS data were linked with EBC markers (pH and IL-β) and nasal tryptase. No associations with 8-isoprostane in EBC and nasal ECP were observed. Itchy rash during the last 12 months and familial asthma were linked with yearly average BC at the home. Conclusion: This study adds to existing evidence that air pollution affects respiratory health in children, and that these effects might be mediated by oxidative stress. The study was financed by the Flemish Administration of Environment, Nature and Energy (LNE), Flemish Environment Agency (VMM), and Flemish Agency for Care and Health (VAZG).

Abstract Number	**P-2-02-12**
Presenter	Paulo Afonso André*, Simone Miraglia, Paulo Hilário Saldiva
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Impact of diesel vehicle inspection on health: the experience of Sao Paulo, Brazil

Around 25% of the Brazilian population lives in 6 Metropolitan Regions. Because of their quick growth without necessary urban planning, mobility was mainly provided by vehicles using fossil fuels, which constitute the most significant air pollution source, consistently associated to adverse health effects. In fact, traffic may be considered as a new epidemical condition relevant to public health. Diesel is by far the dominant source of particulate matter in urban areas. Previous studies have shown that diesel emissions account for 40% of the PM2,5 concentration in São Paulo Metropolitan Region (SPMR). Its use has been restricted with the adoption of a progressive reduction on emission limits and a mandatory annual inspection and maintenance (I/M) program but this program is running only in São Paulo city. Our objective is to assess the impact of this program on health for the population of the SPMR in 2011. Vehicles that fail the emission test must undergo maintenance before a new inspection. The reduction induced by the I/M program is defined as the difference between the first and last inspection emissions of failed vehicles, weighted by annual mileage average and engine and fleet characteristics. Here, mortality refers to individuals over 40 years of age. As suggested by the WHO (2006), an increment of 10 µg/m3 on PM2.5 concentration induces an increment of 6% in mortality. Economic valuation was based on the DALY method as recommended by the WHO (1996), adapted to Brazilian conditions, and related to the increase in life expectancy attributed to air pollution reduction. Only 75% of São Paulo's diesel fleet was inspected during 2011 but this program may be associated to a reduction of 1.18 µg/m3 in PM2.5 concentration and avoided about 584 deaths with an economic impact of US$ 77.1 million. Assuming that the same results hold for the whole SPMR, 1,560 deaths could be avoided with an equivalent economic impact of US$ 206.0 million annually.

Abstract Number	**P-2-02-13**
Presenter	Kazunari Onishi*, Shinji Otani, Mu Haosheng, Takenobu Hosoda, Yae Yokoyama, Youichi Kurozawa
Exposure	ambient air pollution
Health domains	infectious diseases
Type of research	health impact assessment

Increased risk of hospitalization for hand, foot, and mouth disease caused by Asian dust in Japan

Background In 2011, the hand, foot, and mouth disease (HFMD) outbreak occurred in mainland Northeast Asia. Thereafter, the incidence of HFMD hospitalization was higher than the average annual incidence in Tottori, Japan. However, there were relatively fewer HFMD hospitalization cases in 2012. Asian dust (AD), the agent might responsible for the spread of foot and mouth disease (FMD), contains the virus Aphtae epizooticae that causes FMD in animals. AD also causes diverse health issues and symptoms in humans, and several cases have been widely reported. However there is no report about infection disease with AD for human. Aims We investigated the possible causes for hospitalization of patients due to HFMD caused by AD events. Methods Bioaerosol samples were collected from rooftops, and the enterovirus was analyzed using seminested polymerase chain reaction. Data on suspended particulate matter (SPM; particle size < 10 μm) and hospitalization were obtained from the Tottori prefectural institute of public health. Results A total of 11 AD events occurred in 2011 in Tottori, while 2 such events occurred in 2012. The number of cases of HFMD hospitalization increased significantly after the increase in SPM (indicator of AD particle amount). However, we could not detect the enterovirus in the collected samples. Conclusions Although we were unable to detect the enterovirus, we have not enough samples for analysis at this study. Future studies need to employ better analysis methods and consider genetic features. Some researcher previously reported AD transport microorganism. We should consider with migrant bird and mechanism of transport virus with AD.

Abstract Number	**P-2-02-14**
Presenter	Marjo Niittynen*, Erkki Pärjälä, Jouni T. Tuomisto
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Increased use of biomass in combined heat and power production: health impacts due to PM2.5 emissions

Background: Combined heat and power production (CHP) is an efficient way of energy supply widely used in Finnish population centers. EU´s climate policies recommend increased use of biomass in energy production in order to reduce CO2 emissions. However, health impacts on general population may vary depending on the fuel due to differences in fine particle (PM2.5) emissions. Aims: Here we compared two scenarios of fuel use, business as usual (BAU) and increased biomass use (IBU), in Haapaniemi CHP power plant (total fuel power 404 MW) of the city of Kuopio, Finland. According BAU fuels are peat 84%, heavy oil 12% and biomass 4%, whereas according IBU the fuels are peat 49.5%, heavy oil 1% and biomass 49.5%. Methods: The annual amounts of energy produced per fuel were calculated using an on-line city-level energy balance tool adjusted for Kuopio (http://en.opasnet.org/w/Energy_balance_in_Kuopio). Respective PM2.5 emissions were calculated using appropriate emission factors for CHP plants of this size. The attributable all-cause deaths due to PM2.5 emissions were calculated for Finnish population using an appropriate intake fraction. Results: Annual PM2.5 emissions were 64 t (12-116) and 59 t (9-110) for BAU and IBU, respectively, causing 0.12 (0.02-0.22) and 0.11 (0.02-0.21) attributable deaths in Finland, respectively. In addition, actual PM2.5 emissions for year 2010 (42.4 t; fuels as in BAU) and an estimate for 2014 (19.8 t; fuels as in IBU) were used in an independent estimation of health impact, giving the result of 0.08 and 0.04 attributable all-cause deaths in Finland, respectively. Conclusions: Increasing the use of biomass from 4% to 49.5% of total fuel amount in Haapaniemi CHP plant may slightly reduce PM2.5 emissions. The used on-line energy balance tool gives comparable results to the actual measured values. From health point of view – when considering all-cause mortality due to PM2.5 emissions - replacing peat with biomass in large CHP plants seems neutral.

Abstract Number	**P-2-02-15**
Presenter	Sofie De Prins*, Gudrun Koppen, Griet Jacobs, Evi Dons, Els Van de Mieroop, Vera Nelen, Frans Fierens, Patrick De Boever, Bianca Cox, Tim S. Nawrot, Greet Schoeters
Exposure	ambient air pollution
Health domains	no health domain
Type of research	health impact assessment

INFLUENCE OF AIR POLLUTION ON GLOBAL DNA METHYLATION IN HEALTHY ADULTS: A SEASONAL FOLLOW-UP

Background: DNA methylation changes are potential pathways of environmentally induced health effects. Air pollution might affect global DNA methylation through induction of oxidative stress. Aims: We investigated whether exposure to ambient concentrations of NO2, PM10, PM2.5 and O3 and traffic parameters were associated with global DNA methylation in blood of healthy adults. Methods: 48 healthy non-smoking adults (25 males) with a median age of 39 years were sampled in winter and summer. Global DNA methylation in whole blood was analyzed with HPLC. The relative content of 5-methyl-2'-deoxycytidine was expressed as a percentage (%5mdC) with respect to the total amount of cytosine. Exposure to air pollutants at the home address was assessed using interpolated NO2, PM10, PM2.5 and O3 concentrations for various exposure windows (60- to 1-day moving average exposures and yearly averages) and GIS-based traffic parameters. Associations between pollutants and %5mdC were tested with multiple mixed effects regression models. Results: Average %5mdC (SD) was 4.30 (0.08) in winter and 4.29 (0.08) in summer. Repeated measures were weakly correlated (Pearson r = 0.22). Men had higher %5mdC compared to women both in winter (4.32 vs. 4.26) and summer (4.31 vs. 4.27). When winter and summer data were analyzed together, various NO2, PM10 and PM2.5 moving average exposures were associated with changes in %5mdC (95% CI) ranging from -0.04 (-0.09 to 0.00) to -0.14 (-0.28 to 0.00) per IQR increase in pollutant. NO2, PM10, PM2.5 and O3 moving average exposures were associated with decreased %5mdC (95% CI) varying between -0.01 (-0.03 to 0.00) and -0.17 (-0.27 to -0.06) per IQR increase in pollutant in summer but not in winter. Estimates were the highest for PM2.5. Conclusion: Decreased global DNA methylation in whole blood was associated with exposure to NO2, PM10, PM2.5 and O3 at the home addresses of healthy non-elderly adults. The study was partly financed by the Flemish Administration of Environment, Nature and Energy (LNE) and the EU-FP 6 INTARESE project.

Abstract Number	**P-2-02-16**
Presenter	Michela Baccini*, Annibale Biggeri, Dolores Catelan, Laura Grisotto, Pietro Alberto Bertazzi, Dario Consonni, Paolo Grillo, Giorgia Randi
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Inter-municipal commuting and impact of PM10 on mortality in the Lombardy region, Italy

Background. In evaluating the impact of air pollution on human health, the assumption of a static population is usual. However, daily commuting between home and work/school place may influence the impact estimate in the presence of different levels of exposure over the area of interest. Mobility in the Lombardy region is important, with the largest percentage of resident population which moves daily to its job or school place among the Italian regions. Moreover the air pollution levels are heterogeneus, with very high concentrations in the Po river plain. Aims. Our aim was to quantify the short term impact of PM10 exposure on mortality in the Lombardy region during 2007, accounting for inter-municipality school and job commuting. Methods. We used inter-municipality commuting flows from the 2001 census to estimate the yearly number of attributable deaths in each municipality. We assumed that the commuters were exposed to the PM10 levels of the municipality where they work or study for one third of their time. Bayesian geostatistical models were specified to obtain shrunken estimates of PM10 annual levels and crude mortality rates at the municipality level, while we used the estimated effects of PM10 from a meta-analysis involving the 13 largest municipalities of the region. We accounted for all sources of uncertainty through a Monte Carlo simulation approach. Results. In 2007, annual PM10 levels exceeding 20 µg/m3 were responsible for 711 deaths in the whole region. The capital city, Milan, spreaded its impact in the surrounding areas: 284 deaths were attributable to the air pollution level in Milan, 7% of which among residents in other municipalities. Conclusions. Accounting for commuting provides information on the impact that the air pollution level in each single municipality has on the whole region. This may help to detect areas where air pollution reduction interventions are a priority in order to protect and improve individual and community health.

Abstract Number	**P-2-02-18**
Presenter	Bobvos Janos*, Anna Páldy, Marta Szalkai, Balazs Fazekas, Tamas Pandics
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Long term health effect of PM2.5 in selected cities of Central Europe between 2005-2010

Background/Aims: The long term adverse impacts of PM2.5 are well known, methodologies of health impact assessment were elaborated by the APHEKOM project. We aimed to study the long term impact of PM2.5 in central European cities to provide a basis for air quality amendment plans. Methods: Daily mean PM2.5 or PM10 concentrations were provided by the environmental agencies of the relevant countries/regions. If not measured, PM2.5 concentration was computed from PM10 by using a conversion factor of 0.7. Total non external mortality and population data were gained from the statistical offices. The number of avoidable death cases as well as the gains of life expectancy was computed according to the APHEKOM methodology by applying two scenarios: reducing yearly mean PM2.5 concentration by 5 µg/m3, respectively to 10 µg/m3. The following cities were involved: Sosnowiec (Poland), Usti nad Labem (Czech Republic) Velenje (Slovenia), Várpalota (Hungary), Turin (Italy) in the period of 2005-2010. Results: The computed yearly mean PM2.5 concentration was between 15.3 µg/m3 (Velenje 2008) and 45.2 µg/m3 (Sosnowiec 2008). The calculation of potential benefit of the reduction of PM2.5 exposure showed that the gain was bigger if the yearly mean concentration would be reduced to 10 µg/m3. The most lives, 270 per 100 000 inhabitants could have been saved in Sosnowiec in 2006 and the least lives (20 per 100 000 inhabitants) in Velenje in 2007. The reduction of PM2.5 concentration by 5 µg/m3 would save less lives in each year (between 14-47 cases/100 000) in each city. The potential gain in life expectancy of 30 years old population according to the scenarios was between 0.2 (Velenje 2006) and 1.8 (Turin 2006). Conclusion: The study showed that the long term exposure to population was considerable in the selected industrial cities. The results can be used in the municipal strategies to reduce air pollution. The study was funded by the Take a Breath/TAB Central Europe Programme 2007-2013/3CE356PE.

Abstract Number	**P-2-02-19**
Presenter	Albino Barraza-Villarreal*, Ana Teresa Romero-Calderon, Hortensia Moreno-Macias, Joel Manrique-Moreno, Horacio Riojas Rodríguez, Yessica Torres Dorín-Ramos, Juan José Hick-Gómez, Benigno Segovia-Linares, Beatriz Cárdenas-González, Claudia Barcena-Blancart
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Oxidative stress markers, lung function and exposure to air pollutants in Mexican schoolchildren.

Objective: To evaluate the impact of exposure to air pollutants on increased levels of oxidative stress markers and decreased lung function in schoolchildren from Salamanca and Leon, Guanajuato, Mexico. Methods: We included 149 asthmatic and 165 non-asthmatic schoolchildren. We measured conjugated dienes, Lipo-hydroperoxides, malondialdehyde, and Carbonylation of proteins by spectrophotometry and realized pulmonary function tests. Health information was obtained by questionnaire. The information of air pollutants (O3, SO2, CO, PM2.5 and PM10) was obtained from fixed stations located in both cities and we ran multiple linear regression models to evaluate the association. Results: The median age of children with asthma was 9 years and 9 and 9.5 in non-asthmatics. The average levels of oxidative stress markers were higher in Salamanca schoolchildren ($p < 0.05$). The median of 24 hrs maximum of ozone and PM2.5 was 56.7 and 36.4 ppb and 58.7 and 70.0 ug/m3, of both cities respectively. We observed a negative effect of exposure to PM2.5 and PM10 on markers of oxidative stress for Salamanca's asthmatic children and non-asthmatic children from Leon, Guanajuato ($p < 0.05$) and a negative effect on lung function in non-asthmatic of both cities ($p < 0.05$). Conclusions: The results demonstrate that exposure to air pollutants increase levels of oxidative stress markers and decreased lung function in children with and without asthma.

Abstract Number	**P-2-02-20**
Presenter	Andrea A Baccarelli, Yinan Zheng, Xiao Zhang, John P. McCracken, Anaité Diaz Artiga, Chang Dou, Pietro Alberto Bertazzi, Joel D. Schwartz, Sheng Wang, Lifang Hou*
Exposure	metals
Health domains	respiratory disease
Type of research	health impact assessment

Particulate matter, metal components, and lung function in a highly exposed population

Background: Exposure to ambient particulate matter (PM) has been associated with reduced lung function and other respiratory diseases. However, the contribution of PM elemental components to respiratory effects remains largely unknown. Aims: To evaluate in a highly-exposed population in Beijing, China, whether exposure to PMand its elemental componentsaffects lung function. Methods: The Beijing Truck-Driver Air Pollution Study conducted shortly before the 2008 Olympic Games (June 15-July 27, 2008) included 60 truck drivers and 60 office workers. On 2 days separated by 1-2 weeks, personal PM2.5 was measured gravimetrically during work hoursusing portable monitors. Eight selected element components (i.e. potassium (K), sulfur (S), iron (Fe), silicon (Si), aluminium (Al), zinc (Zn), calcium (Ca) and titanium (Ti)) were measured by XRF PANanalytical Epsilon 5 analyzer. We measured 5 lung function indicators using EasyOne ultrasonic spirometer, including forced expiratory volume in one second (FEV1), forced vital capacity (FVC), FEV1/FVC, forced expiratory flow 25%-75% (FEF 25-75%), and peak expiratory flow (PFF). We examined the associations of exposures (PM2.5 and 8 components) with the indicators in mixed-effect models adjusted for confounding factors. Results:Mean personal PM2.5 was 126.8 µg/m3 in drivers and 94.6 µg/m3 in office workers (p<0.001). Mean levels of 8 elements in drivers were higher than that in office workers (p<0.001). We did not observe significant differences in the 5 indicators between drivers and office workers. In all subjects, FEV1 was negatively associated with concentrations of Si (-8.5%, 95%CI:-14.8; -2.2, p=0.025), Al (-7.7%, 95%CI:-14.3; -1.2, p=0.037), Ca (-5.1%, 95%CI:-8.6; -1.7, p=0.025), and Ti (-7.2%, 95%CI:-13.2; -1.3, p=0.037). These associations were weaker and non-significant in office workers, but stronger and significant in drivers. Conclusion: Concentrations of Si, Al, Ca, and Ti in particles were associated with decreased lung function. This may indicate an effect of road dust.

Abstract Number	**P-2-02-21**
Presenter	Laura Perez*, Denis Aydin, Leticia Grize, Hansjörg Sommer, Gian-Marco Alt, Roy Eugster, Christian Schindler
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Prevention potential of daily deaths in Switzerland between 2001 and 2010 under a realistic air pollution abatement scenario

Background: Obtaining risk estimates of the association between daily mortality and PM10 on time-series data is highly informative for local policy makers. Translating this information into the health prevention potential that could have been achieved in the past can help policy-makers better understand the impications of the times-series findings. Aims: We estimated the mortality prevention potential that would have resulted from lower daily PM10 levels between 2001 to 2010 in Switzerland for a realistic air pollution abatement scenario, which assumed a constant reduction of daily PM10-levels by 20%. Methods: The prevention potential of deaths over the study period was obtained by subtracting from the daily predicted cases given by a Poisson regression model the hypothesized new cases that would have occurred under this same predictive model if the daily values of PM10 were according to the hypothesized abatement scenario. Poisson regression models were fitted with spline functions of calendar time, polynomial functions of meteorological variables and influenza frequency, and indicator variables for different days of the week and holidays. To evaluate potential latency in effects, PM10 levels in the regression model were introduced with both a 7 and a 28-day lag. Results: Considering a 7-day lag effect of PM10, we estimated that 1493 (95% CI = 735 to 2251) deaths, 0.34% of all deaths, could have been avoided in Switzerland if daily PM10 levels had been 20% lower between 2001 and 2010. When the lag effect was extended to 28 days, the corresponding preventable number were 2857 (95% CI = 1674 to 4040), corresponding to 0.66% of all deaths. Conclusion: Even small abatement strategies can result in improved public health. The prevention potential was three times larger with a 28-day lag than with a 7-day lag suggesting a potential latency of the PM10 effects over several weeks.

Abstract Number	**P-2-02-22**
Presenter	Victoria Likhvar*, Konstantinos Markakis, Myrto Valari, Colette Augustin, Didier Hauglustaine, Sylvia Medina, Mathilde Pascal, Patrick Kinney
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Quantifying future health impacts of air pollution under a changing climate along a range of geographical scales

Whether air pollution-related mortality or morbidity will increase or decrease in the future depends on a wide range of complex and interacting processes. Quantification of health effects of air pollution (HIA) under a changing climate requires data on affected populations, exposures and changes to exposures, valid effect measures, models, and valid concentration–response functions (CRFs). We developed a framework for HIA of air pollution under a changing climate on different geographical scales. Global scale ozone and PM2.5 concentrations were modelled at a mid-21st century horizon (2020, 2030 and 2050) with the coupled LMDz-INCA system and downscaled with the regional scale air-quality model CHIMERE to a 50km grid covering Europe and then at a 4km grid over the Ile-de-France region. We used the air pollution emission scenarios developed by IIASA in the framework of the Global Energy Assessment (GEA) on the basis of the same climate policy storylines as the RCP used in the IPCC process. Mortality data for 193 countries obtained from WHO were weighted according to the population distribution using a population density grid with ~111km resolution worldwide and 50km over Europe. French mortality data were obtained on the lowest administrative division level and rescaled using a population driven proxy to 2km resolution grid for Paris and Petite Couronne and 4km elsewhere. Relative risks and attributable fractions of mortality were modeled using CRFs obtained from epidemiological studies for the association between ozone or PM2.5 and mortality. We compared present-time data (2000-2010) and mid-21st century horizon data and assessed future changes in deaths associated with changes in ozone and PM2.5 concentrations due to RCP scenarios and on different geographical scales.

Abstract Number	**P-2-02-23**
Presenter	Pãmela Rodrigues de Souza Silva, Beatriz Fátima Alves de Oliveira, Washington Leite Junger, Sandra Hacon, Eliane Ignotti*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Risk assessment to health of schoolchildren on exposure to ozone and fine particulate matter from biomass burning in the city of Rio Branco – AC.

Introduction: Ozone (O3) and fine particulate matter (PM2,5) are the pollutants with the greatest impact on public health. About 0.7 million deaths from respiratory diseases and 3.5 million deaths from cardiopulmonary diseases occur worldwide each year due to exposure to O3 and PM2,5, respectively, arising from anthropogenic activities.Objective: Risk assessment of exposure to O3 and PM2,5 in schoolchildren aged 6 to 14 years, from the estimate of potential dose ingress in Rio Branco, Acre, 2009. Method: The Risk Assessment methodology was applied to assess the risk of exposure to O3 and PM2,5, from biomass burning in children living in Rio Branco, in the months from August to October 2009, which corresponds to the period of drought. The estimate of ingress potential dose for pollutants O3 and PM2,5 was performed by Monte Carlo simulation according to age, sex, asthma and body mass index. The toxicologic risk was estimated by ratio between of the potential dose and reference dose for each pollutant studied. Results: The highest concentrations of O3 and PM2,5 in 2009 reached 119.4 µg/m3 and 51.1 µg/m3, respectively. The schoolchildren have incorporated doses averages potential for exposure to O3 of 2.83 µg/kg.dia (CI 95%: 2.72 - 2.94) and for PM2,5 of 0.93 µg/kg.dia (CI 95%: 0.86 - 0.99). To exposure to O3 toxicologic risk was greater than 1 for all children (QR = 2.75; CI 95%: 2.64 - 2.86). Conclusion: Children living in Rio Branco, a city located in the Brazilian Amazon were exposed to high doses of O3 pollution in the dry period in the region, presenting toxicological risk to the pollutant. To exposure to PM2,5 schoolchildren showed no toxicological risk.

Abstract Number	**P-2-02-24**
Presenter	Anna Páldy*, János Bobvos, Marta Szalkai, Balazs Fazekas, Tamas Pandics
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Short term health effect of PM10 in selected cities of Central Europe between 2006-2010

Background/Aims: By declaring 2013 the Year of Air the EU called the attention on the importance of improving air quality. The adverse impacts of PM are well known, methodologies of health impact assessments are available. We aimed to study the short term effects of air pollution in central European cities in order to provide municipalities with data. Methods: Daily mean PM10 concentrations were provided by the environmental agencies of the relevant countries/regions. Total non external mortality and population data were gained from the statistical offices. The yearly excess death cases attributable to daily mean PM10 >50 µg/m3 was calculated by the free software AirQ2.2 developed by WHO. The potential benefit of reducing PM10 concentration was computed using two scenarios (reducing yearly mean concentration by 5 µg/m3, respectively to 20 µg/m3 by the APHEKOM methodology in Sosnowiec (Poland), Usti nad Labem (Czech Republic) Velenje (Slovenia), Várpalota (Hungary), Turin (Italy) in the period of 2006-2010. Results: The yearly mean PM10 concentration was between 64.2 (Turin 2006) and 21.9 µg/m3 (Velenje 2008). The excess mortality due to the short term impact of daily mean PM10 concentration over 50 µg/m3 was between 0.4-12.4 death cases per 100 000 in 2006, in the most polluted year and between 0.1-8.6 cases per 100 000 in the least polluted year 2009. The two scenarios of potential benefit of the reduction of PM10 showed that the gain is bigger if the yearly mean concentration is reduced to 20 µg/m3. The gain was the highest in each city in year 2006 saving the lives between 1.9 (Velenje) and 25.4 people (Sosnowiec) per 100 000 inhabitants. The reduction of concentration by 5 µg/m3 would save less lives in year 2006 (between 1-13 cases/100 000) in each city. Conclusion: Based on the study a SWOT analysis should be carried out to prepare a common intervention strategy. The study was funded by the Take A Breath/TAB Central Europe Programme 2007-2013/3CE356PE.

Abstract Number	**P-2-02-25**
Presenter	Hsiao-Chi Chuang*, Kai-Jen Chuang, Hao-Cheng Chen, Chih-Cheng Chang, Tsun-Jen Cheng
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Surface charge of particles is a key determinant for interaction with protein

Background: Combustion-derived nanoparticles are harmful for human health, but the pysicochemical characteristics of particles remain unclear. Objective: To investigate the interactions of biological fluids with particle surfaces, which exhibit high affinity for protein and particle surfaces. Methods: Using bovine serum albumin and mice bronchoalveolar lavage fluid as models for protein-particle conjugates, we characterized the physicochemical modifications of hydrophobic carbon-based particles after protein treatment. Results: Significant modification of the physicochemistry of nanoparticles was induced by the addition of serum protein, and a significant correlation was observed between the particle surface charge and protein bondability. Conclusion: With regard to human health, the present study revealed that these hydrophobic carbon-based nanoparticles can react with lung epithelial lining fluids after inhalation and may modify the functional structures of lung proteins.

Abstract Number	**P-2-02-26**
Presenter	Ana Rappold*, Neal Fann, Wayne E. Cascio, Robert B. Devlin, David Diaz-Sanchez
Exposure	climate change (temperature)
Health domains	costs
Type of research	health impact assessment

Use of Wildfire Smoke Forecasting Model to Mitigate Burden on a Population's Health and Wellbeing

Background Wildfires are a major source of fine particular matter and other air pollutants associated with adverse health outcomes. A number of methods are available to forecast wildfire plume transport, but there is no systematic public health program that mitigates the burden on a population's wellbeing. Objective To evaluate the feasibility of a smoke forecasting system to mitigate health care utilization and societal cost attributed to a major wildfire. Methods Daily counts of emergency department (ED) visits for cardiorespiratory outcomes were obtained during the period of a major wildfire in North Carolina. Dispersion and chemical transport atmospheric models were used to estimate daily forecast predictions of smoke-related fine particular matter (PM2.5). For each day of the period, spatial regions likely to be impacted under the 24 h and 48 h forecast were determined, followed by the estimation of the expected daily counts in the absence of a smoke event and the subsequent calculation of the corresponding relative risk. Health burden due to smoke exposure was determined by the difference in RR with and without the forecast and was evaluated using the Environmental Benefits Mapping and Analysis Program for incidence of cardiorespiratory outcomes, school absences and lost work days. Results A reduction from 50% to 0% excess risk (per 100µg/m3 PM2.5) at lag 0 and from 20% to 1% at lag 1 was observed for asthma. Statewide hospitalization rate of ED visits associated with asthma was 19% with expected total cost of illness per individual of $10K and average hospital stay of 3 days for those 64 yrs and younger and $15.8K with 4.79 day average stay for 65 yrs and older. We will present the results on the corresponding reduction in health burden and the amount of time before the health savings are equal to the cost of remediation. Conclusion This study demonstrates the ability of forecasting to mitigate smoke-related health care utilization and social costs. Disclaimer: This abstract does not necessarily reflect U.S. EPA policy.

Abstract Number	**P-2-02-27**
Presenter	Hanns Moshammer*, Hans-Peter Hutter
Exposure	ambient air pollution
Health domains	policy
Type of research	others

Worldwide associations between air quality and health end-points. Are they meaningful?

Background: The World Health Organization provides data on national indices of health, environment and economy. When we were asked, why air pollution is negatively correlated with cancer mortality, our first response (likely the mortality data are not age adjusted) proved to be wrong. So we analysed the WHO data in more detail. Method: A table was combined including all-cause mortality (range per 100,000: 220-3147, cancer (59-284) and childhood mortality (per 1000 live births: 2-133), life expectancy (47-83 years), gross national product per person (320-61,240 USD), smoking prevalence (2-55%), physician density (0.85-61.67 per 10,000) and PM10 (11-279 µg/m^3) per country (n=193). For explorative purposes weighted cross-sectional multiple linear regressions models were built. Results and discussion: Air pollution (population averaged annual PM10) is correlated positively with infant mortality (R=0.56) and overall mortality (0.45) and negatively with life expectancy (-0.52). This might not only depict a true causal effect of PM10 because air quality is also an indicator of the country's prosperity: if it neither has the financial resources nor the political commitment to fight air pollution it likely faces similar problems with other key health determinants like access to drinking water. Cancer mortality is negatively correlated with PM10. But this association is weakened when controlling for economic or health system indicators. Cancer deaths in poorer countries are apparently not only reduced by competing causes but also by under-diagnosis. Conclusions: WHO's world-wide data sets provide an interesting overview and demonstrate the great disparity in our world. However, interpretation is difficult. Lay persons jump at cancer because they perceive this as a hallmark of an environmental disease which it is likely less than others. A far more careful and professional approach is needed. Therefore WHO should provide interpretation and guidance with its publicly available data.

Abstract Number	**P-2-04-02**
Presenter	Drew Michanowicz*, Leah Cambal, Jessie Carr, Brett Tunno, Sara Gillooly, Jeffrey Howell, Sheila Tripathy, Courtney Roper, Kyra Naumoff-Shields, Jane Clougherty
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A HYBRID LAND USE REGRESSION/CALINE3 MODEL FOR PREDICTING NO2: A SEASONAL COMPARISON

Background: Land use regression (LUR) models describe spatial relationships between distributed pollutant concentration measures and geographic information systems (GIS)-based indicators of source intensity. Most LUR models include little physical, chemical, or meteorological information in the selection or application of source covariates. Spatial concentration estimates from near-surface dispersion algorithms (e.g., CALINE, CALPUFF) may improve LUR model fits for NOX by incorporating short-term variation in meteorology, traffic volumes, and local wind variability with respect to roadway geometry. Aims: We aim to include line-source (Gaussian plume) dispersion model estimates as a covariate in LUR prediction of intra-urban variability in NO2 in Pittsburgh, PA. We will leverage seasonal differences in NO2 estimates and LUR model results to disentangle contributing components of dispersion model inputs. Methods: We collected five-day (Monday-Friday) integrated NO2 measures using passive diffusive badges, analyzed using UV-Vis spectroscopy, from 38 locations during summer and winter 2011-12. We implemented CALINE3 (CAL3QHCR), using NOX fleet-wide emissions factors (MOVES2010) and hourly traffic counts on primary roadways within a 1000m radius of monitoring locations. NO2 model predictions were temporally adjusted using contemporaneous measurement (background concentration) and surface and upper air meteorological data. Results: Incorporating CAL3QHCR estimates into LUR models improved regression fits from R2 = 0.70 to 0.79 during summer, and from R2 = 0.72 to 0.77 during winter. In both hybrid LUR models, the prior traffic covariates lose significance when the CAL3QHCR term is included, thus explaining more variability with less predictor variables. Conclusions: Inclusion of meteorological information and pollutant dispersion processes using line-source Gaussian dispersion models improved LUR model fits for NO2, providing more robust and mechanistic estimates of NO2 from traffic in both seasons.

Abstract Number	**P-2-04-03**
Presenter	Alessandra Gaeta*, Carla Ancona, Carla Ancona, Andrea Bolignano, Giorgio Cattani, Giulia Cesaroni, Alessandro Di Menno di Bucchianico, Francesco Forastiere, Fabrizio Sacco, Roberto Sozzi
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A land use regression model for ambient nitrogen dioxide concentration nearby a commercial airport for low-cost flights (Rome-Ciampino)

Background: Several studies suggest that airport emissions could worse air quality in theneighbourhoods. Aims: To evaluate the spatial variability of nitrogen dioxide (NO2) concentrations in relation with the main pollution sources (airport and road traffic) using Land Use Regression models (LUR). Materials and Methods: 46 Palmes diffusion tube samplers were deployed within a 64 km2 domain centred in the Ciampino airport (Rome, Italy) over two 2-weekly periods (June 2011 – January 2012). GIS-derived predictor variables, with varying buffer size, were evaluated to model spatial variation of NO2annual average concentrations. Aircraft specific contribution to hydrocarbon concentration was estimated using a Lagrangian dispersion model (SPRAY). A stepwise selection procedure was used to develop the linear regression models. The models were validated using leave one out cross validation (LOOCV) method. Results: The developed LUR model included the product of traffic intensity and the inverse distance to the nearest major road squared, traffic intensity on nearest road, total traffic load of all roads in a 300 m buffer. It explained 64% of the variance in the spatial distribution of NO2 concentrations (RMSE =±10.5 µg/m³; LOOCV-R2=0.58). Forcing the model to include airport-related hydrocarbon concentration (though if not statistically significant) slightly improved the model performance (R2=0.66) with no effect on the adjusted R2. Adding a geographical coordinate (the North latitude) helped to reduce the RMSE (± 9.5 µg/m³) and brought to an higher R2 (0.73) and a higher LOOCV-R2 (0.62). Conclusions: Long term exposure of people living around the airport borders was well described by the developed LUR model. Spatial variability in the investigated area was mainly related to road traffic proximity. The airport contribution to long term averaged NO2 levels in the neighbourhoods was masked by the vehicle emissions from existing surrounding high traffic density roads.

Abstract Number	**P-2-04-04**
Presenter	Jina Heo*, Hyo-Mi Kim, Jong-Tae Lee
Exposure	metals
Health domains	other
Type of research	cross-sectional study

A Study of the Relationships Between Proximity to an Industrial Complex and Blood Lead Levels and Urinary Cadmium Levels

Background: Most people spend their time in their house, and live around their residence. So, we supposed that their exposure levels were associated with the location of residence. Aims: The goal of this study was to investigate the relationships between proximity to an industrial complex and blood lead levels and urinary cadmium levels. Methods: We conducted a questionnaire survey and analyzed blood lead and urinary cadmium levels using Atomic Absorption Spectrometry (AAs). Data was analyzed using logistic regression analysis. The distance between the residence and an industrial complex was calculated through a Geographical Information System (GIS). Results: A total of 967 residents living near a large petrochemical complex in Ulsan participated. The geometric mean levels of blood lead and urinary cadmium were 1.70 μg/dl (male: 1.77 μg/dl, female: 1.67 μg/dl), and 0.72 μg/g creatinine (male: 0.49 μg/g cr. female: 0.89 μg/g cr.), respectively. Blood lead and urinary cadmium levels both increased with age and were higher among smokers compared to never smokers.Results from multiple logistic regression analysis showed that urinary cadmium levels for subjects aged less than 20 years old were negatively associated with distance from the industrial area to the residence (OR=1.09[1.05-1.14]). The results, however, indicated that the blood lead levels were positively associated with the distance (OR=0.77[0.70-0.82]) Conclusions: The results of this study support that proximity to an industrial complex is related to urinary cadmium values for children. A positive finding with blood lead can be explained by the ambiguity of lead exposure sources in the general environment.

Abstract Number	**P-2-04-05**
Presenter	Luiz Pereira*, Missagia Suelem, Camila Amaral, Alessandra Jesus, Marcos Arbex, Carmem de Andre, Paulo de Andre, Ubiratan Santos, Lourdes Martins, Saldiva Paulo, Alfésio Braga
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

ADOLESCENTS AND ITS ASSOCIATION WITH INHALABLE PARTICULATE MATTER (PM10) IN A BRAZILIAN MEDIUM-SIZED CITY

Few studies using epidemiological individual designs have been found in the literature investigating the association between respiratory diseases and air pollutant emissions in small and medium cities. Objective: To evaluate the effects of air pollution on respiratory symptoms and peak expiratory flow (PEF) in students from three public schools located in areas of exposure to air pollution mining plume dispersion in small Brazilian city. METHODS: Panel study. Two groups were defined according to exposure status for industrial emissions. Among all students enrolled in schools, we selected 121 between 8 and 16 years old. The sample size was based on the prevalence of respiratory diseases in the municipality. After answering a self-reported respiratory symptoms questionnaire (ISAAC), daily PEF measurements were performed in each one of selected students, twice a day. Average daily PM10, temperature and humidity were collected by the monitoring network during one year. Association between daily records of PEF and PM10 were assessed using mixed effects regression models, controlling to the average temperature, humidity, exposure status, and body mass index. RESULTS: Four participants gave up and 117 were evaluated: 65 in exposed and 52 in unexposed areas. About 70,000 PEF measures were performed. Asthma prevalence was 16.9% in the exposed area and 15.4% in the unexposed area. For all participants, increases of 14μg/m3 of PM10 were associated with decreases of PEF measurements in the morning and in the evening (-1.04%, 95% CI: -1.32; -0.77 and -1.2%, 95% CI: -1.49; -0.92 respectively). For the asthmatic group, increases of PM10 also induced decreases of PEF in the morning and in the evening (-1.21%, 95% CI: -1.80; -0.62 and -1.66%, 95% CI: -2.27; -1.05 respectively). CONCLUSIONS: There was an association between the increasing of PM10 and reduced lung function in the entire study population, regardless of the exposure area, mainly in the asthmatic group.

Abstract Number	**P-2-04-06**
Presenter	Steven Lacey*, Ramon Lopez
Exposure	others
Health domains	other
Type of research	exposure modeling

Application of a two-zone exposure model to medical laser-generated particulate matter for two simulated surgical procedures

Background Laser-generated air contaminants from medical procedures have been shown to cause respiratory inflammatory response in animal models, and there is some evidence to suggest bacteria and virus transfer to healthcare personnel. Modeling medical laser-generated particulate matter exposures may be useful in estimating exposure levels in clinical settings during procedures, and in assessing control strategy effectiveness. Aims Our objective was to apply a two-zone exposure model using laboratory-derived particle mass emission rates to estimate particulate mass concentrations in two clinical settings. Methods Particle mass emission rates determined from laboratory-based emission chamber simulated surgical procedures using an Ultra MDTM40 C02 laser system (Laser Engineering Inc., USA) on porcine tissue were used to inform a two-zone exposure model to determine potential exposures to healthcare personnel. Theoretical procedure rooms were modeled using two room volumes (22.5 and 170 m3), air exchange rates (6 and 15 ACH) and interflow rates between zones (9 and 30 m3/min) to estimate exposures. Results Modeled concentrations for the near-field ranged between 0.03 and 0.5 mg/m3 and between 0.01 and 0.4 mg/m3 for the far-field. The lower air exchange rate led to a doubling of particulate matter concentration in the smaller room volume, but did not have an effect on the concentration in the larger room. Steady state concentration in the larger room volume was reached within fifteen minutes, but continued to rise in the smaller room. Conclusions Concentration estimates in the simulated scenarios were similar to previously reported field assessments in hospital operating rooms. Our results fall below the ACGIH TLV of 10 mg/m3 for inhalable particles and 3 mg/m3 for respirable particles for particulates not otherwise specified, but direct comparison is inappropriate due to the biologically active nature of these particles.

Abstract Number	**P-2-04-07**
Presenter	Limaye Vijay*, Monica Harkey, Paul Meier, Tracey Holloway, Jonathan Patz
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Climate Change Impacts on Power Plant Emissions, Air Quality and Health in the Eastern US

Background Air pollution effects from climate change rank high among future health concerns. Nearly 70 million Americans live in areas exceeding air quality standards for fine particulate matter (PM2.5), while 120 million reside in counties exceeding 8-hour ozone standards. Climatic effects on air quality are documented for ozone but not for PM2.5, a more hazardous pollutant. Because a key source of PM2.5 is fossil fuel combustion, an increase in emissions from higher electricity demand during hotter summers has been posited. Aims We quantify future electricity sector emissions in response to climate warming and assess health impacts. A coupled modeling approach is used to identify populations in the Eastern US exposed to future air pollution-related health risks from climate change. Methods We model the atmospheric effects of climate change on air quality for current and future climates, climate impacts on future summer electricity demand and resulting emissions, and health risks from climate change-driven increases in ozone and PM2.5 air pollution. The US Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program is utilized to estimate health risks using concentration-response and economic valuation functions for air pollution-related health outcomes. Results Preliminary results indicate an average mid-century summer temperature of 27.7° C and a 16% increase in summer electricity consumption compared to 2007. Expected results include estimates of health impacts (morbidity and mortality) from ambient air pollution exposure. The excess health burden and its associated monetary impact from exacerbated air pollution will be estimated. Conclusions This study represents a novel approach integrating climate, air quality, energy, and health models to identify key climate- and air quality-related health impacts. The integrated effort provides a framework applicable to risk assessment for other populations of the industrialized world facing linked air quality-energy-health risks.

Abstract Number	**P-2-04-08**
Presenter	Mercedes Bravo*, Sergey Napelenok, Michelle L. Bell
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Comparison of Exposure Estimation Methods for Air Pollutants

Background and Aims: Ambient monitors are often used to estimate air pollution exposure for epidemiological studies. This approach is efficient and economical but has limitations, including restricted coverage and resolution. Although three-dimensional air quality modeling has its own limitations, this emerging exposure approach has the potential to address some challenges of monitoring networks. We evaluated differences in exposure estimates obtained using monitoring data and simulation results based on the Community Multi-scale Air Quality (CMAQ) modeling system. Methods: Spatially-aggregated (county-level) exposure estimates for PM2.5 were calculated for the eastern two-thirds of the U.S. for years 2002-2006 from three sources: (1) 24hr ambient monitoring data; (2) 12 x 12 km gridded CMAQ simulation results; and (3) concentration estimates from a Bayesian space-time downscaler model “fusing” PM2.5 monitoring data with 12-km gridded CMAQ output (i.e., downscaler-derived exposures). Results: Exposure estimates generated from CMAQ and the downscaler provide greater spatial and temporal coverage compared to estimates from monitor data. The CMAQ and CMAQ-downscaler exposure estimates included 2818 counties and the monitoring approach produced estimates for 190 counties, which contain ~51% of the population within the CMAQ domain. Exposure estimates derived from CMAQ results underestimated PM2.5 levels (normalized mean bias [NMB]=-4.0%), while downscaler-derived exposures slightly overestimated observed PM2.5 (NMB=1.0%). Across time, correlation between monitor-derived exposure estimates and CMAQ- and downscaler-derived exposure estimates were 0.62 and 0.97, respectively. Conclusions: The downscaler approach had superior performance based on several metrics. Epidemiology may benefit from use of regional air quality models, with improved spatial and temporal coverage and ability to study populations far from monitors that may differ from those near monitors.

Abstract Number	**P-2-04-09**
Presenter	Kees de Hoogh*, Meng Wang, Ming-Yi Tsai, Rob Beelen, Bert Brunekreef, Gerard Hoek
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Development of LUR models for particle composition in 20 study areas in Europe

Background Land Use Regression (LUR) models have been used to describe/model spatial variability of annual mean concentrations of traffic related pollutants like nitrogen dioxide (NO2), nitrogen oxides (NOx) and particulate matter (PM). No models have yet been published of elemental composition. Aims To describe the development and performance of LUR models in 20 study areas across Europe, for 8 a priori selected trace elements: copper (Cu), iron (Fe), potassium (K), Nickel (Ni), vanadium (V), sulphur (S), silicon (Si) and zinc (Zn) in both the PM2.5 and PM10 size fractions. Methods As part of the ESCAPE project, we measured the elemental composition in both the PM10 and PM2.5 fraction sizes at 20 sites in each of 20 study areas across Europe. LUR models for eight a priori selected elements; Cu, Fe, K, Ni, V, S, Si and Zn were centrally developed using a standardised approach. Results Substantial variations of annual mean concentrations were observed within and between the majority of study areas and elements. The largest within-area contrasts were generally found in South European study areas. LUR models could be developed for the majority of the study areas and elements. Conclusions Good models were developed for Cu, Fe and Zn in both fractions (PM10 and PM2.5) explaining on average between 67 and 79% of the concentration variance (R2) with a large variability between areas. Traffic variables were the dominant predictors, reflecting non-tailpipe emissions. Models for V and S in the PM10 and PM2.5 fractions and Si, Ni and K in the PM10 fraction performed moderately with R2 ranging from 50 to 61%. Si, NI and K models for PM2.5 performed poorest with R2 under 50%. On average, elemental PM10 models in most study areas explained a higher variance than elemental PM2.5 models. The LUR models are used to estimate exposures to elemental composition in the health studies involved in ESCAPE.

Abstract Number	**P-2-04-10**
Presenter	Salem Albalawi*, Susan Hodgson, Anil Namdeo, Tanja Pless-Mulloli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Exploring the Influence of Time-Activity Patterns on Personal Exposure to PM2.5 in Different Microenvironments in Al Jubail Industrial City, Saudi Arabia

Background: Many epidemiological studies use outdoor concentrations of air pollutants as a proxy for personal exposure. However, exposure will result not only to these outdoor concentrations but to the concentrations in the different microenvironments in which a person spends time. In recent years technology has improved such that personal monitoring of indoor and outdoor micro environments is possible. While there is a growing literature on time activity patterns and micro-environment exposures for populations in the USA and Europe, little research on this topic has been carried out in the Middle East. Amis: To explore the influence of Time-Activity Patterns on personal exposure to PM2.5 in different microenvironments in Al Jubail Industrial City, Saudi Arabia. Methods: 28 students aged between 16-18 years old were recruited and asked to record their detailed movements on a time-activity diary, at 15 minute intervals, over 24 hours and to carry a small backpack containing a personal air monitor, to measure personal exposure to PM2.5, as well as a GPS device to help identify microenvironments, including travelling, outdoors, at school, at home, and inside other locations. Results: The majority of total time spent was indoors (88.7%) similar to figures reported in EU and North America studies. Indoor away from home microenvironments (shops, restaurants & gyms) had the highest PM2.5 concentrations (86 µg/m3) followed by transport (car, bus, taxi) (65 µg/m3) and outdoor away from home (park, beach) (52 µg/m3). Lowest PM2.5 concentrations were found indoors at school and home (29 µg/m3) and (36 µg/m3) respectively. All microenvironment categories exceed the reference concentration (25 µg/m3) of WHO air quality guideline. Conclusion: The time activity patterns and microenvironment PM concentrations in the Middle East are not well characterised. While there appear to be similarities between time activity patterns in this small population sample from the Middle East and Europe/USA, the exposure levels in this industrial city appear very high.

Abstract Number	**P-2-04-11**
Presenter	Duck Shin Park*, Jin Ki Eom, Keun Yul Yang, Soon-Bark Kwon, Wootae Jeong, Ki Chul Cho, In Young Jeong, Sung-Joon Bae, Kiyoung Lee
Exposure	others
Health domains	other
Type of research	exposure measurement

Exposure assessment on the relationship between daily activity patterns and indoor air quality in university buildings

Abstract This study analyzed the impact of the spatial-temporal distribution of occupants on indoor air quality. To observe daily building usage by students, Dongnam Health University with about 5,000 students and staffs was selected as the survey site, and the survey was conducted on 500 students (10%) as a sample to represent the activities all students. The students' activities were surveyed and classified into seven categories (work, study, exercise, circle, recreation, others, and trip) to know how long they stayed in the space between 6 a.m. to 24 p.m. Based on the survey results, an hourly activity behavior profile of students in each building was obtained in the statistical model. While the survey was conducted, PM10 concentration and CO2 concentration were measured using a dust spectrometer (Grimm Inc., model 1.108) and IAQ monitor (Senscube Inc.), respectively, inside eight buildings on the campus. The indoor PM10 concentration was found to be more affected by outdoor concentration rather than the number of occupants while indoor CO2 concentration was found to be affected more by the number of occupants. This study was the first attempt to apply the spatial-temporal distribution of occupants for managing indoor air quality using a statistical model and is intended to propose a new method for managing indoor air quality.

Abstract Number	**P-2-04-12**
Presenter	Sergey Grinshpun, Michael Yermakov, Jinyong Kim, Tiina Reponen, Patrick Ryan*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

How Does an Anti-Idling Campaign Affect the Indoor Aerosol at Schools?

Background: Traffic pollutants, which may be elevated near schools, are associated with health effects in children. Various measures have been implemented to reduce the particle emission from cars and buses delivering students to schools, including anti-idling campaigns. Although these measures may reduce the outdoor concentration of fine particulate matter (PM2.5), elemental carbon (EC), organic carbon (OC) and other traffic related elements, it remains unclear how these changes affect the indoor aerosol concentrations in schools. Aims: To determine the impact of changes in outdoor concentrations of PM2.5 and its traffic-related constituents, resulting from an anti-idling campaign, on the indoor aerosol concentration at four schools. Methods: Outdoor and indoor aerosol samples were collected at four schools for five days before and after an anti-idling campaign using Teflon and Quartz filters. The mass concentration of PM2.5 and EC, OC, Si, S, Ti, V, Mn, Fe, Cu, Zn, Br, and Pb were assessed for each day of sampling. The correlation between indoor and outdoor concentrations was determined for PM2.5 and each element. Results: Following the anti-idling campaign significant reductions in outdoor concentrations were observed for most elements. Corresponding to these reductions (in percent) were decreases in indoor concentrations of the respective elements in all four schools ($R2 = 0.78, 0.89, 0.72$, and 0.86; $p < 0.01$). A significant reduction in outdoor PM2.5 was observed for one school. Changes in outdoor PM2.5, however, were not always followed by similar changes in indoor PM2.5. Conclusions: The findings suggest that aerosols originated by traffic near schools significantly affect exposure inside the schools. Particles emitted from traffic can readily penetrate the schools whereas the PM2.5 mass concentration is represented mostly by larger particles exhibiting lower infiltration; indoor PM2.5 sources may also play a role.

Abstract Number	**P-2-04-13**
Presenter	Itai Kloog*, Francesco Nordio, Brent A. Coull, Joel D. Schwartz
Exposure	ambient air pollution
Health domains	other
Type of research	exposure modeling

Incorporating Local Land Use Regression And Satellite Aerosol Optical Depth In A Hybrid Model Of Spatio-Temporal PM2.5 Exposures In The Mid-Atlantic States

Aims: We aimed at extending our previous work by validating our model in another region with different geographical and metrological characteristics, and incorporating fine scale land use regression and nonrandom missingness to better predict PM2.5 concentrations for days with or without satellite AOD measures. Methods: We start by calibrating AOD data for 2000-2008 across the Mid-Atlantic. We used mixed models regressing PM2.5 measurements against day-specific random intercepts, and fixed and random AOD and temperature slopes. We used inverse probability weighting to account for nonrandom missingness of AOD, nested regions within days to capture spatial variation in the daily calibration, and introduced a penalization method that reduces the dimensionality of the large number of spatial and temporal predictors without selecting different predictors in different locations. We then take advantage of the association between grid-cell specific AOD values and PM2.5 monitoring data, together with associations between AOD values in neighboring grid cells to develop grid cell predictions when AOD is missing. Finally to get local predictions (at the resolution of 50m), we regressed the residuals from the predictions for each monitor from these previous steps against the local land use variables specific for each monitor. Results: For all days without AOD values, model performance was excellent (mean "out-of-sample" $R2=0.81$, year-to-year variation 0.79-0.84). Upon removal of outliers in the PM2.5 monitoring data, the results of the cross validation procedure was even better (overall mean "out of sample" R2 of 0.85). Further, cross validation results revealed no bias in the predicted concentrations (Slope of observed vs. predicted = 0.97-1.01). Conclusions: Our model allows one to reliably assess short-term and long-term human exposures in order to investigate both the acute and effects of ambient particles respectively).

Abstract Number	**P-2-04-14**
Presenter	Dikaia Saraga*, Thomas Maggos, Evangelia Diapouli, Kostas Eleftheriadis, Sotirios Karavoltsos, Aikaterini Sakellari, Christos Vasilakos
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Indoor and outdoor PM source apportionment study during a period of extensive fireplaces use in Athens, Greece.

Background. During the last two years of the Greek economic crisis, apartments' fireplaces have been extensively used as a cheap way for domestic heating even in densely populated cities as Athens.As a result, especially during winter 2012-13, the phenomenon of smog covering many urban and suburban areas of the city was intensively noticed. Therefore, the scientific interest focuses on the smog's chemical composition and particulate matter concentration, with regards to both short and long-time effects on population's health. Aims. This study aims at identifying the main sources contributing to outdoor and indoor PM levels during a period of fireplace extensive use (12/2012-01/2013, Christmas holidays). A focused source apportionment study will quantify the fireplaces-source contribution to the measured concentrations. Methods. Continuous 12-hour indoor and outdoor PM10 and PM2.5 measurements were conducted in an apartment situated in a suburb of Athens. Particle chemical analysis for ions, metals and organic/elemental carbon is currently in progress and collected data will be injected in Positive Matrix Factorisation (PMF) model for a source apportionment analysis. Results. Preliminary results show thatPM10 and PM2.5 mass concentration levels during weekends and holidays were elevated by up to 7.4 and 5 times respectively compared to those during working weekdays. Particles concentration during afternoon/night period (intense fireplace use) was up to 5.5 times elevated compared to early morning/noon period. PMF analysis will be performed on particles chemical composition data. Conclusion. PMF analysis will focus on the prospect of the identification of separate combustion sources. The difference between sources contributions to indoor versus outdoor particles as well as the different source apportionment during morning/noon and afternoon/night periods will be examined.

Abstract Number	**P-2-04-15**
Presenter	Ghislaine Bouvier*, René de Seze, Gaelle Coureau, Blandine Vacquier, Isabelle Baldi
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure measurement

RF and ELF electromagnetic field exposure of children in the french ELFE birth cohort

Background : Knowledge on Radiofrequency (RF) and Extremely Low Frequency (ELF) electromagnetic fields (EMF) exposure of children remains scarce, despite their growing use and their potential health effects. There is a need for studies taking into account every source of children exposure, including emerging ones, with longitudinal design to capture changes while growing, from in-utero to the adolescence. Aims: to characterize and follow RF and ELF exposure in children of the French ELFE birth cohort. Methods: 18918 children born in 2011 have been included. RF and ELF exposure will be assessed by questionnaires. Jobs and company activity will be coded with international classifications, and a job-exposure matrix will be applied to assess maternal occupational exposure during pregnancy. Domestic uses (Wi-Fi, cordless phone, mobile phone, electrical appliances, transportation means…) will be collected on questionnaires. Residential exposure will be assessed by using geocoded residential addresses and mapping of EMF sources. An exposure study will be performed in a subgroup of 400 children (when 3 yrs old). Housing and household characteristics and a time-activity diary will be completed, and numerous RF bands and ELF 50Hz will be measured at different places in each room and during 24 h in the living room. Results : questionnaires at birth, 2 months and 1 year of life have been already administered, and follow-up at 2 years is scheduled in 2013. Perspectives: Interactions between EMF and other radiations or chemical exposures will be studied, in relation with health outcomes collected at each follow-up. Other factors influencing children's health and development (social, psychological, medical and familial factors), also collected will allow an accurate assessment of the etiology of health events. Future collaboration with other international birth cohorts to better understand the etiology of rare diseases such as pediatric cancers will be considered.

Abstract Number	**P-2-04-16**
Presenter	Jorge Pey, Noemi Perez, Xavier Querol, Andrés Alastuey, Francesco Forastiere, Massimo Stafoggia*, Study group MED-PARTICLES
Exposure	ambient air pollution
Health domains	no health domain
Type of research	time series study

Saharan dust and forest fires in Southern Europe in the period 2001-2011: estimation and geographical distribution

Aim. In the context of the MED-PARTICLES project (EU LIFE+ ENV/IT/327) African dust outbreaks and wildfires over southern Europe were studied from 2001 to 2011, devoted to quantify short-term health effects of particulate matter over the Mediterranean region by distinguishing particle sizes, chemical components and sources. Methods. PM10 data from 19 regional and suburban background sites in the Mediterranean area were compiled. Daily influence of African dust and wildfires was assessed for each area, African dust contributions to PM10 were estimated and wildfire smoke plumes were classified according to their intensity. Results and conclusions. African dust outbreaks are more frequent in southern Mediterranean sites (30-37% vs. 20% days/year). A decreasing south to north gradient of African dust contribution to PM10 is patent. Higher annual dust contributions are encountered in the eastern Mediterranean with significantly higher contributions in autumn-spring and occurrence of various severe episodes throughout the year (over 100 µg m-3 dust in PM10). Clear summer prevalence is observed in the western part, with low occurrence of severe episodes. African dust emerges as the largest PM10 source in regional background southern sites of the Mediterranean (35-50% of PM10) with peak contributions up to 80% of the total PM10 mass in the eastern side. The multi-year study of African dust episodes and their contributions to PM10 displays a consistent decreasing trend in the period 2006/2007 to 2011 in the NW Mediterranean, almost parallel to that of NAO (North Atlantic Oscillation) index for the summer period, progressively more negative since 2006. As a consequence, a sharp change in the atmospheric circulation over the last 5 years has affected the number of African dust episodes and consequently the annual dust inputs to PM10 observed. Wildfires are more frequent in the eastern Basin, mainly concentrated in the warm season. A progressive decrease of wildfire events is observed in the western Mediterranean Basin.

Abstract Number	**P-2-04-17**
Presenter	Harish C. Phuleria*, Alex Ineichen, Elisabetta Corradi, Ming-Yi Tsai, Christian Schindler, Nicole Probst-Hensch, Nino Kuenzli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

SEASONAL AND SPATIAL VARIATION OF INDOOR AND OUTDOOR PARTICULATE MASS AND NITROGEN DIOXIDE CONCENTRATION IN EIGHT SWISS AREAS

Background: This study is part of the Swiss Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA), a nearly 20-year old cohort study spread in eight geographically diverse areas in Switzerland. Innovative outdoor PM10 and NO2 exposure modeling has been conducted in SAPALDIA earlier for PM10 and NO2, however, its relationship with indoor levels has not been assessed. Aims:The overarching aim is to provide estimates of individual long-term home outdoor traffic-related air pollution exposures for all cohort participants. This paper focuses on seasonal and spatial variation of residential outdoor PM10, PM2.5 and NO2 and its correlation with indoor pollutant levels. Methods: Biweekly NO2 measurements are made at 40 outdoor locations in each study area over three different seasons during 2011-2012. Four (of the eight) areas are additionally monitored for indoor and outdoor PM2.5, PM10, and indoor NO2 at 20 locations. NO2 is measured using passive Passam tubes while PMx are measured using Harvard Impactors at a flow rate of 4L/min. Detailed home characteristics and indoor activities are also recorded for each monitored homes. Results: Mean biweekly outdoor NO2, aggregated across all seasons and sites, is highest in Lugano (32.4±14.9 micrg/m3) and lowest in Montana (12.6±8.3 micrg/m3). Across all eight areas, winter levels are highest (range: 15.9-44.7 micrg/m3) and summer lowest (7.2-20.8 micrg/m3). The indoor NO2 levels are about half of the outdoor levels in winter across all areas but similar in summer. Seasonally averaged outdoor PM10 and PM2.5 ranged 9.7-40.5 micrg/m3 and 5.7-36.8 micrg/m3, respectively. Corresponding indoor levels are 8.1-28.1 micrg/m3 and 4.6-22.1micrg/m3, respectively. Computation of area-specific indoor versus outdoor and between pollutant correlations is currently underway. Conclusions: Our results show significant seasonal differences in outdoor PMx and NO2 levels and large spatial differences within and across Switzerland.

Abstract Number	**P-2-04-18**
Presenter	Aileen Yang*, Bryan Hellack, Gerard Hoek, Bert Brunekreef, Thomas A. J. Kuhlbusch, Flemming Cassee, Nicole Janssen
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Spatial and temporal variation of the oxidative potential of PM2.5 and its relation to PM2.5 mass concentrations

Background Oxidative potential (OP), defined as the capacity of airborne particulate matter (PM) to oxidise target molecules has been proposed as an alternative metric to PM mass concentrations. There is currently limited information on the spatial and temporal variation of OP. Aim: To assess the spatial and temporal variation of OP, and its relation to PM2.5 mass concentrations. Methods We measured OP and elemental composition in PM2.5 quartz samples from 3 regional background, 3 street sites and 5 urban background sites across the Netherlands.We selected samples every 6th day from year 2011, resulting in over 600filters. OP was measured as the ability to generate hydroxyl radicals in the presence of hydrogen peroxide with the electron spin resonance (ESR) assay. Results Annual averages for PM2.5 mass concentrations varied from 14 at a regional background site to 18 µg/m3 at a street site. PM2.5 mass concentrations for different sites were highly correlated (r= 0.66-0.94, p<0.01), and correlations generally decreased with increasing distance between sites. Preliminary results for OP show greater contrast between sites, with more than 3 times higher values for the street site compared to the corresponding urban background site in the same area. We observed no significant temporal correlations between OP and mass concentrations for all sites. Conclusion We observed small differences for the annual PM mass concentrations for different sites across the Netherlands. Our preliminary results suggest larger spatial variation in OP compared to PM2.5 as well as low temporal variation between OP and PM2.5. This will allow evaluation of the independent health effects of OP in epidemiological studies.

Abstract Number	**P-2-04-19**
Presenter	Sheila Tripathy*, Jessie Carr, Brett Tunno, Drew Michanowicz, Fernando Holguin, Jane Clougherty
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Spatial Variability of Chronic Stressors and Fine-Scale Air Pollution Based on Proximity to Patient Residences of the Pittsburgh AsthmaNet Cohort

Spatial Variability of Chronic Stressors and Fine-Scale Air Pollution Based on Proximity to Residences of the Pittsburgh AsthmaNet Cohort Sheila Tripathy1, Jessie Carr1, Brett Tunno1, Drew Michanowicz1 Fernando Holguin2, Jane E. Clougherty1 1University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA 2Asthma Institute, Division of Pulmonary, Allergy, and Critical Care Medicine, University of Pittsburgh Background: Environmental and social exposures are not randomized in the design of clinical trials and these factors may modify treatment results. VIDA and APRIL-OCELOT are two clinical trials developed by AsthmaNet using a cohort of asthmatics residing in 14 different US cities. There is a need for methods to understand potential spatial confounding among multiple exposures for clinical trials research. Aims: We used Geographic Information Systems (GIS) to (1) geocode the addresses of Pittsburgh AsthmaNet patients, (2) assess spatial and temporal variability of fine-scale chronic stressors and air pollution based on proximity to residential locations during treatment, and (3) determine if these exposures vary significantly based on spatial variability of demographics. Methods: A geodatabase of publicly available data was developed compiling social stressors relevant to asthma and indicators of socio-economic status. Inclusion criteria included publicly available datasets collected uniformly across all 14 AsthmaNet cities with concurrent temporality to AsthmaNet clinical trials. Intra-urban patterns of NO2, O3 and PM2.5 were examined for Pittsburgh, and compared with variability of chronic stressors and demographics. Results: Chronic stress and fine-scale air pollution vary spatially across the domain of geocoded Pittsburgh cohort residences. Conclusions: GIS methods are implemented to understand spatial variation of exposures including air pollution and social stressors. Methods validated from this study will be implemented for all 14 AsthmaNet cities and will later be used to interpret the influence of exposures on clinical trial results.

Abstract Number	**P-2-04-20**
Presenter	Hyunok Choi*, Steven Melley, John D. Spengler
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Ten-Year Trend of Air Toxics in Krakow, Poland

BACKGROUND: Krakow, Poland, represents a typical coal-dependent region within Europe. Yet, long-term air quality in this region is not well characterized. AIMS: Goals of the present analysis are: 1) describe ambient air concentration trend of PM2.5, PM10, SO2, O3, NOx, NO, NO2, and NOx during 2000-2010 period; 2) describe spatial trend over six routine air-monitoring locations, and; 3) develop a prediction models for city-wide monthly mean of the eight species over the ten-year period. METHODS: Routine, 24-hour averaged, ambient monitoring data were obtained for January, 2000 to December 2010 period in six stations across Krakow, Poland. In order to investigate the spatial and temporal trend, we grouped the sites into three types – traffic oriented (TO), industry oriented (IO), and those that generally reflect of citywide levels(CW). Generalized additive models for each air toxics were developed for the entire city during the available period. RESULTS: For all of the measured air toxics, season was associated with 2- to 3-fold variability in geometric mean concentrations. Compared to CW, TO site was associated with a seasonal variability of 28.5 vs. 62.9 µg/m3 for PM2.5 during 2009–2010 period (range, 3-350 µg/m3). Seasonal geometric means for PM10 were 47.4 vs. 68.2 µg/m3 (range, 5-592 µg/m3). In contrast, significantly higher concentration NO, NO2, and NOx were observed during both heating (October—March) and non-heating (April—September) period at TO. In all sites, the daily PM2.5 and PM10 concentration levels exceeded the U.S. National Ambient Air Quality Standards and the European Union concentration limits, particularly duringthe heating season. CONCLUSIONS: Over a decade, a downward trend was seen for SO2 and O3. An upward trend was observed for NO and NOx. In contrast, little temporal or spatial trend for PM10 across the same period suggest complex contributions by coal-burning, traffic and industrial sources.

Abstract Number	**P-2-04-21**
Presenter	Dev Jani, David Reed, Tracy Middleton, Lisa Detter-Hoskin, Michele Harmon, Anja Schulze, Andrew Lawson, Erik Svendsen*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Validation of a Chlorine Gas Plume Dispersion Model with Available Indicator Data

Background: Computer-generated atmospheric dispersion models have the ability to simulate the contaminant plume after a toxic chemical has been released into the air. However, validation of these models with observed indicators is often necessary to ensure predictive accuracy. Aims: We validated a plume dispersion model generated by the Hazard Prediction and Assessment Capability (HPAC) computer program with observed animal toxicity, phytotoxicity, and corrosion from the Graniteville, SC, USA (2005) chlorine spill. Methods:Animal toxicity- We analyzed 211 dogs affected by the Graniteville chlorine spill. Each dog was assigned an outcome severity category by a public health veterinarian blinded to animal location after reviewing all available veterinary health information. Each animal was then assigned an exposure category based upon the dosimetry literature and reported outcome severity. Phytotoxicity- Chlorine-bleached or scorched vegetation was noted and mapped. This phytotoxic visual evidence was then used to conservatively estimate the spatial extent of the plume in excess of 4.67 ppm for 2 hours. Acid Corrosion- Visual inspections and portable XRF field measurements were performed to determine the types and scope of pitting corrosion on metals. A subset of samples was laboratory tested for chlorine exposure and all samples indicated exposure in excess of 70 ppm. Statistical Analysis - Exposure concentration data were generated in a GIS from the HPAC plume dispersion model for locations where observed vegetative damage, acid pitting corrosion, and animal toxicity was observed. The modeled exposure concentrations were compared with the indicator data. Results: The modeled exposure concentration data were significantly correlated with the damaged plants, acid pitting corrosion, and injured dog ($R2 = .237$) indicator data ($p < 0.0001$). Conclusion: Our HPAC plume dispersion model exposure estimates were significantly correlated with corrosion, phytotoxicity, and animal toxicity data from the 2005 Graniteville chlorine spill.

Abstract Number	**P-2-04-22**
Presenter	Jaime E. Hart*, Jennifer Prescott, Immaculata De Vivo, Francine Laden
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

A cross-sectional assessment of ambient air pollution exposure and leukocyte telomere length in US women

Background: Telomeres are repetitive sequences of nucleotides at the end of chromosomes that function to maintain structural integrity. Telomere length varies considerably among individuals and typically decreases with age, and telomere shortening has been shown to be accelerated by oxidative stress and inflammation. Shorter telomere length has been associated with decreased life-expectancy and increased rates of cardiovascular disease (CVD) and cancer, similar to ambient air pollution. To date, however, only a few studies have examined the association of telomere length and exposures to ambient or occupational air pollution. Aims: We aimed to determine if ambient air pollution exposures were associated with shorter leukocyte telomere length (LTL) in US women. Methods: Information on LTL from a real time PCR assay was available for 9,074 members of the Nurses' Health Study. All blood samples were collected 1989-1990 from women free of disease. To adjust for batch-to-batch variability in LTL, we log-transformed each measurement and calculated a batch-specific z-score. Spatiotemporal model predictions were used to determine the average concentrations of PM2.5, PM10, NO2, and SO2 in 1988 for each participant based on her residential address. We also calculated the distance in meters to the nearest major roadway as a measure of exposure to traffic. Robust regression with adjustment for known lifestyle predictors of LTL was used to determine the percent difference in LTL for each standard deviation increase in air pollution, or to compare women within 50m of a major road to those further away. Results: In adjusted models, there was no association of LTL with distance to road, PM10, NO2, or SO2. However, each 1 SD increase in PM2.5 (4 µg/m3), was associated with a 3.4% (95%CI: 1.0-5.9%) increase in LTL; the equivalent association in nonsmokers was 4.5% (95%CI: 0.9-8.3%). Conclusions: In cross-sectional analyses, LTL was not associated with measures of traffic or air pollution, with the exception of a positive association with PM2.5.

Abstract Number	**P-2-05-01**
Presenter	Rey Decastro*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Acrolein and COPD in a Nationally Representative Sample of United States Adults 55 and Over

BACKGROUND: Acrolein is an air toxic and tobacco smoke toxicant that laboratory studies suggest may adversely affect pulmonary function. There is strikingly little epidemiology available, however, even though US EPA's 2005 National-Scale Air Toxics Assessment (NATA) estimates that acrolein is responsible for about 75 percent of non-cancer respiratory health effects attributable to air toxics in the United States. AIMS: Characterize the association between model-estimated outdoor acolein exposure and the prevalence of self-reported COPD. METHODS: Sample-weighted statistical analysis characterized the association between self-reported doctor-diagnosed COPD ("emphysema") and NATA acrolein exposure estimates at the census tract geographically linked to residences of subjects ≥55-years-old in the National Health Interview Survey (NHIS) 2000 - 2009 (n = 89,475). RESULTS: Preliminary results indicate that among never smokers and never & former smokers, outdoor acrolein exposure (1.38E-4 to 4.57E-1 ug/m3) was not associated with COPD prevalence at a statistically significant level, controlling for potential confounders. CONCLUSIONS: Outdoor acrolein exposure is unrelated to COPD prevalence in a nationally representative sample of United States adults 55 and over.

Abstract Number	**P-2-05-02**
Presenter	Pauline Mendola*, Rajeshwari Sundaram, Kira Leishear, Tuija Mannisto, Danping Liu, Candace Robledo, Qi Ying, Seth Sherman, S. Katherine Laughon
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Air pollution and preterm birth – are women with asthma at greater risk?

Background: Ambient air pollution and maternal asthma have been independently associated with preterm birth (PTB). Poor placentation and immunologic pathways are suspected mechanisms underlying PTB risk for mothers with asthma suggesting early pregnancy exposure is important. Aims: To investigate whether first trimester air pollution exposures confer greater PTB risk among women with asthma. Methods: In a United States cohort of 223,502 singleton deliveries (2002-08), average levels of particulate matter (PM) 10 and PM2.5, ozone (O3), carbon monoxide (CO), nitric oxides (NOx), and sulfur dioxide in the first trimester were based on US EPA Community Multiscale Air Quality model predictions. Health data, including clinical estimate of gestational age, were derived from electronic medical records. Generalized estimating equations with log link computed the relative risk (RR) of PTB (<37 weeks) and risk of delivery dichotomized for each week from 31 to 37 for one-unit increase in pollutant with adjustment for demographic, lifestyle and clinical factors and the interaction between asthma and pollutant. Results: PTB was more common among mothers with asthma (15%) compared to non-asthmatics (11%). For NOx, the PTB RR=1.007 (95% confidence interval: 1.002-1.013) for asthmatics and RR=0.988 (0.986-0.989) for non-asthmatics. For births <31 weeks, significantly higher risk for women with asthma was observed for PM10: RR=1.034 (1.010-1.059); CO: RR=1.002 (1.001-1.003); NOx: RR=1.033 (1.019-1.047) in contrast to lower risks for women without asthma, PM10: RR=0.994 (0.987-1.001); CO: RR=0.998 (0.998-0.999); NOx: RR=0.987 (0.983-0.992). With the exception of O3, risks were generally increased among asthmatics but not non-asthmatics for all criteria air pollutants. Conclusion: First trimester air pollution appears to increase PTB risk in women with asthma but not among women without asthma. At earlier gestational ages, the risk difference is more pronounced.

Abstract Number	**P-2-05-03**
Presenter	David Olsson*, Ingrid Mogren, Bertil Forsberg
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Air pollution exposure and adverse pregnancy outcomes

Background: An increasing number of studies have reported an association between higher levels of air pollution and adverse pregnancy outcomes. A shorter gestation and being growth restricted as an infant have been linked with higher morbidity, higher mortality and worse educational performance in later life. Aims: Our aim was to study possible associations between exposure to elevated levels of air pollution, ozone (O3) and vehicle exhaust, during early gestation and adverse pregnancy outcomes such as preeclampsia, preterm birth and small for gestational age. Methods: We used register data on single pregnancies and births from the Swedish Medical Birth Register during 1998 – 2006 (n = 120 755) and air pollution data from monitoring stations in Stockholm. City-wide first trimester averages for O3 and nitrogen oxides (NOx) were used as exposure indicators. To assess the relationship between early gestation exposure to air pollution and adverse pregnancy outcomes we used logistic regression analysis. Results: 4.4 % of pregnancies resulted in a preterm birth. The prevalence of preeclampsia was 2.7 %. We observed an association between first trimester O3 and preterm birth (OR = 1.04, 95 % CI =1.01 – 1.08) as well as an association with preeclampsia (OR = 1.04, 95 % CI = 1.01 – 1.08), per 10 µg/m3 increase in O3. We observed no association between first trimester NOx and adverse pregnancy outcomes. No associations were observed between any of the air pollutants and small for gestational age. Conclusions: Increased levels of O3 during the first trimester increased the risk of preeclampsia and preterm birth. Air pollutants did not exhibit an effect on fetal growth restriction.

Abstract Number	**P-2-05-04**
Presenter	May Irina*, Zaitseva Nina
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

AN ASSESSMENT OF THE IMPACT OF EMISSIONS FROM OIL STORAGE AND TRANS-SHIPMENT FACILITIES ON THE HEALTH OF LOCAL CHILDREN

AN ASSESSMENT OF THE IMPACT OF EMISSIONS FROM oil storage and trans-shipment facilities on the health of local children Background: The residents of an area where oil storage and trans-shipment facilities are located, complained about poor ambient air quality. 55% of the residents associated air pollution with the deterioration of their health. business entities affirmed that they were complying with the regulations. Aim: To objectively determine whether there was a relationship between the activity of the emission sources and the health of the local residents. Methods: We analyzed the parameters of emissions into the atmosphere, calculated pollutant dispersion, measured the concentrations of pollutants in the ambient air, and performed health risk assessment, an analysis of morbidity in children and calculated the odds ratios. Results: In the areas influenced by the emissions from the oil storage and trans-shipment facilities (300 to 500 m from the production site), an unacceptable risk to the respiratory tract (hazard index (HI) at 3.73), the immune system (HI=3.08), the central nervous system (HI=2.07), blood (HI=1.57), etc. was shown to develop. Major risk factors were hydrogen sulfide, benzene, phenol, formaldehyde, mercaptans. The frequency and severity of respiratory, immune and nervous system diseases as well as disorders in coagulation processes, etc. in the children from the polluted areas were significantly higher than those in the children from a control group (OR from 2.1 to 3.7, $p<0.05$). Overall, the proportion of healthy children was only 18.5% of the total number of children with exposure, which itself was almost 3 times lower than in the control group (47.9%). Compliance orders stating additional health and environmental measures were issued to the companies. Conclusion: The proven relationship between the emissions, environmental pollution and the health of the residents in the studied area are the bases for making management decisions and improving the environmental health situation

Abstract Number	**P-2-05-05**
Presenter	Maria Alejandra Pila Villalobos, Jose Guillermo Alonso Arvizu*, Ruth Araceli De Celis Carrillo
Exposure	ambient air pollution
Health domains	cancer
Type of research	cross-sectional study

Asbestos and Malignant Pleural Mesothelioma in the Metropolitan Area of Guadalajara, Jalisco.

BACKGROUND: Asbestos is a mineral fiber complex, that are directly related to the development of malignant pleural mesothelioma (MPM) This compound is banned in countries such as North America, Europe and some Latin countries including our country, but by 2000, Mexico imported 27,000 tons, when it was known that asbestos is carcinogenic. OBJETIVE: To investigate whether the presence of asbestos fibers is associated with increased MPM in the Metropolitan Zone of Guadalajara (ZMG) METHODOLOGY 1.- MPM cases were collected from the database of the Division of Pathology, in the Western National Medical Center belonging to Mexican Social Secure Institute (IMSS) and the State Cancer Registry in Jalisco 2.- A review of the places of residence of MPM cases, locating the ZMG colonies that have as many tanks and asbestos shingles. 3. The roads with a flow greater than 10,000 cars per day were identified. RESULTS: For the period 1998 to 2009, the number of cases reported nationally MPM was 1730 and the sum of those reported by the State Cancer Registry and the Division of Pathology were 348, for the state of Jalisco. To this period there were 2769 deaths from MPM due to cancer of the trachea and lung, the latter are also associated with the presence of asbestos in the air. Colonies have a greater number of tanks and asbestos shingles are located in neighborhoods of Analco, Mexicalzingo, Mezquitan, San Juan de Dios and Santuario in the city of Guadalajara. For Zapopan region, colonies Vergel, Tabachines and Auditorio.. The busiest roads of the ZMG with a flow greater than 10,000 cars per day are: Lazaro Cardenas, Federalismo, Colón, Patria, Vallarta, Periferico, Javier Mina, Tesistan Road, Rio Nilo,and Mariano Otero. CONCLUSION: The widespread use of asbestos in water tanks, tiles and semi-metallic pads, has led the state of Jalisco to position in the first place nationally in deaths from MPM.

Abstract Number	**P-2-05-07**
Presenter	Wenqi Gan*, Mark Fitzgerald, Christopher Carlsten, Mohsen Sadatsafavi, Michael Brauer
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Associations of Ambient Air Pollution with Chronic Obstructive Pulmonary Disease Hospitalization and Mortality

Background: Ambient air pollution has been suggested as a risk factor for chronic obstructive pulmonary disease (COPD). However, there is a lack of prospective epidemiologic studies to support this assertion. Aims: To investigate the associations of long-term exposure to elevated woodsmoke and traffic-related air pollution with the risk of COPD hospitalization and mortality. Methods: This population-based cohort study, including a 5-year exposure period and a 4-year follow-up period, was conducted in metropolitan Vancouver, Canada. All residents aged 45-85 years who resided in the study region during the exposure period and did not have known COPD were included. Residential exposures to woodsmoke and traffic-related air pollutants, including black carbon, particulate matter < 2.5 µm in aerodynamic diameter, nitrogen dioxide, and nitric oxide, were estimated using land-use regression models and integrating changes in residences during the exposure period. COPD hospitalizations and deaths during the follow-up period were identified from hospitalization and death registration databases. The data were analyzed using the Cox proportional hazards regression model. Results: A total of 467,994 subjects were included in this study. After adjustment for multiple potential confounders, an interquartile range elevation in black carbon concentrations (0.97×10–5/m, about 0.78 µg/m3 elemental carbon) was associated with a 6% (95% confidence interval, 2-10%) increase in COPD hospitalizations and a 7% (0-13%) increase in COPD mortality. Exposure to higher levels of woodsmoke pollution (tertile 3 versus tertile 1) was associated with a 15% (2-29%) increase in COPD hospitalizations. There were positive exposure-response trends for these observed associations. Conclusions: Ambient particulate air pollution, including woodsmoke and traffic-related fine particulate pollution, is associated with an increased risk of COPD hospitalization and mortality.

Abstract Number	**P-2-05-08**
Presenter	Christine Loftus*, Michael Yost, Paul Sampson, Catherine Karr
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Beyond traffic: PM2.5 and lung function in a rural cohort study of children with asthma

Background Many studies demonstrate an adverse effect of traffic-derived PM2.5 on children with asthma in urban areas. In agricultural settings, animal operations and crop production are important contributors to PM2.5 but the impacts on childhood asthma are not well characterized. In the Yakima Valley region of Washington State, residents have expressed concerns over the effects of large dairy operations and tree fruit orchards on pediatric asthma morbidity. Aims To determine whether daily lung function of school-aged children with asthma in an agricultural community is associated with ambient PM2.5. Methods Over a two-year period, 58 children with asthma in rural WA State were instructed to provide daily measures of forced expiratory volume in one second (FEV1) using handheld digital peak flow meters. Estimates of exposures to outdoor PM2.5 were determined from a regulatory community monitor in the center of the study region. The effect of 24-hour average PM2.5 on percent predicted FEV1 one day later was modeled using generalized estimating equations (GEE). Interaction terms were included to assess potential effect modification by child's atopy status and overall asthma symptom control. Results Community PM2.5 concentrations ranged from 0.3 to 54.8 ug/m3, with a geometric mean and s.d. of 5.7±2.4 ug/m3. A10 ug/m3 increase in PM2.5 was associated with a 2.2% decrease in FEV1% (95% CI: -0.2, -4.2%) after adjustment for time-varying meteorological covariates. We observed a larger effect for children with atopic asthma (p-value for interaction = 0.12) and for children who demonstrated poorer asthma symptom control than average (p-value for interaction = 0.03). Conclusions Ambient PM2.5 is associated with lung function deficits in this rural cohort where agricultural activities contribute more PM pollution than traditional urban sources, such as traffic. Further characterization of the effects of large-scale agricultural operations on community air quality and the health of vulnerable groups is warranted.

Abstract Number	**P-2-05-09**
Presenter	Gaelle Guyot*, Sandrine Charrier, Rémi Carrié
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

BUILDING USED AS A SHELTER TO PROTECT PEOPLE AGAINST ACCIDENTAL TOXIC RELEASES

Toxic gas clouds origins may be diverse, for example accidental releases due to industry or to hazardous materials transportation, or biological or chemical attacks. European directive concerning major accidents hazards control, known as SEVESO II, requires Member State's local authorities to ensure that appropriate measures are taken to guarantee people's protection when located in areas close to SEVESO facilities. Protective system to such a phenomenon consists in taking advantage of the protection offered by buildings against airborne pollutants. In such an event, people can seek shelter in a building and wait until the toxic plume has gone. In France, following the AZF chemical accident (Toulouse, 2001, 31 deaths), a law adopted in 2003 compels public and private building owners to undertake works to protect occupants. To reduce casualties due to a toxic gas cloud release, they must implement a shelter-in-place strategy. It mainly consists in identifying one room in the building used as a shelter and staying in this room until the toxic cloud has finally been swept off. This strategy called "passive shelter-in-place" also includes closing all external openings and turning off all mechanical ventilation systems and openings. To prove that the shelter air-tightness is sufficient not to expose the occupants to irreversible effects, simulations are required using for instance the freeware-modeling tool CONFINE. Originally developed by CETE de Lyon, this software is a pressure network code modeling pollutant infiltration inside a 3-zone building (shelter, attic and rest of building). The final goal consists in calculating an airtightness level for the room, which can guarantee that toxic concentration in the shelter stays below the irreversible effects threshold. This paper aims at giving an overview of CONFINE (governing equations, modeling hypotheses...) and will illustrate its application on examples of shelter-in-place strategy in residential and public buildings.

Abstract Number	**P-2-05-10**
Presenter	Jesus Serrano*, Brisa N. Sánchez, Natalia Manzano-León, Raúl Quintana, Elizabeth Vega, Leonora Rojas-Bracho, Felipe Vadillo-Ortega, Irma Rosas, Marie S O´ Neill, Álvaro Osornio-Vargas
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Changes in particulate matter soil content drive size, regional and seasonal related inflammatory potential

Background: Epidemiological studies have shown correlations between air pollution and adverse birth outcomes. Currently, we are conducting a cohort study in Mexico City exploring pre-term delivery and pro-inflammatory states related to air pollution. The study has a toxicological arm, evaluating the pro-inflammatory potential of particulate matter samples collected in the city.We aim to understand if particulate matter composition drives size, regional and seasonal related differences in cytokine production among cells in vitro. Methods. PM10 and PM2.5 samples from Mexico City were obtained in five sites with different anthropogenic activities during the 2009 – 2011 wet and dry-cold seasons. Samples (n=90) were used to determine chemical composition [elements, polycyclic aromatic hydrocarbons (PAHs) and endotoxins]. Human cells (THP-1 cells) were exposed to 80 µg/mL of PM10or PM2.5 and pro-inflammatory potential was evaluated in vitro by TNFα and IL-6 secretion. Principal component analysis was applied to PM composition data, ANOVA to determine differences of components per site-season, and correlation/regression analysis to quantify and estimate the effect of PM-components on pro-inflammatory responses. Results. Thirty-two constituents were identified in PM10 and PM2.5. Three principal components were extracted (C1, C2, and C3). C1 grouped metals and PAHs; C2 grouped endotoxins and soil-related elements; and C3 included Li and Cr. Component ratios and pro-inflammatory effects varied by site and season. C2 showed a high association with TNFα ($r=0.79$, $p<<0.05$) and IL6 ($r=0.65$, $p<<0.05$), explaining regional and seasonal differences in pro-inflammatory effects. C2 and TNFα had a significant non-linear relationship. Conclusions. A relationship between PM10 and PM2.5 soil-related content and cytokine production was found. Regional/seasonal differences in pre-term delivery rates related to air pollution may also be observed in our current cohort study.

Abstract Number	**P-2-05-11**
Presenter	Marisa Estarlich*, Miguel Angel Martinez-Beneito, Clara Cavero, Javier García-Pérez, Rebeca Ramis, Carmen Iñiguez, Gonzalo Lopez-Abente, Ferran Ballester, Oscar Zurriaga, Carmen Martos
Exposure	ambient air pollution
Health domains	other
Type of research	others

CONGENITAL HEART ANOMALIES AND INDUSTRIAL SOURCES IN THE VALENCIAN REGION, SPAIN

BACKGROUND: Congenital heart anomalies (CHA) are an important public health threat to the quality of life of affected families. The etiology of most CHA is unknown, suspecting an interaction of multiple genetic and environmental factors, including emissions of polluting industries. The aim is to analyze the relationship between CHA and the industrial pollution in the municipalities of the Valencia Region (VR), Spain METHODS: An ecologic study was designed to analyze CHA prevalence in municipalities of VR during the period 1999–2008. CHA cases were extracted from hospital records. Children younger than one year, born in VR during the study period with at least one diagnose coded as CHA (ICD-9: 745-747) were selected. Health identity number was used for child identification and only the first hospital discharge with CHA was included in the analysis. Exposure to industrial pollution was estimated on the basis of distance between municipalities and industries (obtained from the European Pollutant Release and Transfer Register (E-PRTR)). Bayesian hierarchical models were used to estimate the effect of the exposure on CHA prevalence. We considered the risk surface as a constant plus a Gaussian function decreasing with distance from each industry. The remaining overdispersion was modeled by means of two random effects (spatial and heterogeneous) for every municipality. RESULTS: 6351 CHA were identified. A total of 680 industries, located on the 541 municipalities of the VR and the surrounding 50km, were considered. Although geographic patterns have been identified, no significant relationship was found between CHA and the distance to industrial source (β=0.084 (Credibility Interval (IC) 95%: -0.168; 0.531). CONCLUSION: AnassociationbetweenCHA and distance to industries was not found. The use of registry CHA data, analysis of other types of CHA, use of additional information (socioeconomic, meteorological, ...), and the extension of the study period to improve statistical power are considered as future investigation lines. Funded: FIS PI10/01676

Abstract Number	**P-2-05-12**
Presenter	Julia Dratva*, Nicole Probst-Hensch, Arno Schmidt-Trucksäss, Seraina Caviezel, Eric de Groot, Lanja Saleh, Jean-Michel Gaspoz, Thierry Rochat, Nino Kuenzli, Elisabeth Zemp
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

Early impact of adolescent smoking on atherogenesis – Results from the SAPALDIA Youth Study

Background/Aims: Early exposure to tobacco smoke is associated with various adverse health outcomes in children and adolescents, however little is known on the impact of active smoking on cardiovascular health (CVH) in adolescence. The SAPALDIA Youth Study, a nested study in the Swiss Study on Air Pollution and Lung and Heart Disease In Adults (SAPALDIA) cohort, investigated the association between active smoking and common carotid artery intima media thickness (CIMT). Methods: 288 SAPALDIA offspring underwent a clinical examination following a standardized protocol: anthropometry, blood pressure, ultrasound CIMT assessment and blood draw for cardiovascular biomarkers and serum cotinine. Offspring and parents gave information on early life, health and lifestyle of the child, including smoking status. Multivariable regression analyses on the impact of active smoking on the per subject averages of the common carotid artery images (CIMT mean) was performed, adjusting for main confounders. Results: Valid CIMT data was available in 275 offspring (mean age 15 yrs, 53% girls). Weekly smoking was reported by 10% and current parental smoking by 24%. Individual CIMT means averaged to 0.52 mm (sd 0.05). Regression analyses yielded significant positive associations between mean CIMT (in mm) and weekly smoking (0.025, 95%CI 0.006;0.045), cigarette/day (0.003, 95%CI 0.001;0.005) and serum cotinine (0.008, 95%CI 0.002;0.015). Results remained consistent after adjusting for parental confounders. Conclusion: Our study yields evidence of an early adverse impact of active tobacco exposure on atherogenesis in adolescents, independently of parental smoking, underlining public health importance of prevention of adolescent smoking.

Abstract Number	**P-2-05-13**
Presenter	Andrea Ranzi*, Daniela Porta, Chiara Badaloni, Giulia Cesaroni, Paolo Lauriola, Marina Davoli, Francesco Forastiere
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Early life exposure to air pollution and respiratory symptoms in an Italian birth cohort

Background: Ambient air pollution has been consistently associated with exacerbation of respiratory symptoms in schoolchildren, but the role of early exposure to traffic-related air pollution in the first occurrence of respiratory symptoms and asthma is not yet clear. Aim: We assessed the association between exposure indexes of traffic-related air pollution during early life and respiratory outcomes in a birth cohort. Methods: A cohort of 708 newborns, residents in a district of Rome (Italy), was enrolled in 2003-2004. Direct interviews to the mother were done at birth and at 6, 15 48 months and 7 years of life. Exposure to NO2 was assessed at the residential address for each follow-up periods, using data from Land Use Regression model (LUR). For each residential address, GIS variables of proximity to high traffic roads (more than 10,000 vehicles/day, HTR) were derived. To take into account early pre- and post-natal exposure, lifetime average values of NO2 until 6 months before the date of the follow-up were chosen as principal exposure index. Associations with several respiratory conditions were assessed with logistic regression (odds ratios, OR) using a longitudinal approach (GEE model). Results: There was no significant association between the exposure indices and the respiratory outcomes in the longitudinal model. Increment of 10 mg/m3 of NO2 were weakly associated with asthma incidence (OR=1.05; 95%CI, 0.75-1.47), wheezing (OR=1.07; 95%CI, 0.90-1.27), shortness of breath with wheezing (OR=1.15; 95%CI, 0.93-1.42) and cough (OR=1.11; 95%CI, 0.94-1.32). Conclusions: Both lifetime average exposure to NO2 from a LUR model and distance from HTR were only weakly associated with asthma and respiratory symptoms in early childhood.

Abstract Number	**P-2-05-14**
Presenter	Jan Theunis, Bart Elen*, Joris Van den Bossche, Jan Peters, Bernard De Baets
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Exposure of cyclists to black carbon in an urban environment

Background Cyclists can be exposed to high traffic-related pollution levels. Exposure of cyclists is highly influenced by the traffic conditions and the urban micro-environment. Details on exposure in different micro-environments can help authorities in planning cycling infrastructure, and cyclists in choosing low pollution routes. Aims The aim of this study is to assess the exposure of cyclists to black carbon (BC), as an indicator for traffic-related pollution, in different urban micro-environments, and to identify elements that have an impact on cyclists' exposure. Methods Volunteers of an environmental action group carried out repeated BC measurements on three cycling routes in the city of Ghent on 22 days in a period of 6 weeks in autumn 2012 at three moments of the day. BC measurements were used to calculate the exposure at street level. Results The lowest BC exposures were found in low traffic-streets with low traffic speed, parks and open streets. The highest exposures were measured on roads with intense traffic, in street canyons and in streets without separate biking lane. During a single 30 minutes long commuting event, a 3 minutes cycling period alongside the inner ring road contributed for 25% of the total exposure and the passage through two typical street canyons with moderate traffic for 3 minutes for 15%. In contrast, the exposure during passage through urban green (5 minutes, 3%) or traffic-free streets in the city center (2 minutes, 1%) is typically much lower. Conclusions Cyclists' exposure to traffic-related pollution is influenced by a combination of traffic conditions, street canyon effects and distance to traffic. Separate lanes for cyclists and open spaces reduce exposure significantly. Collaboration with volunteers is a successful strategy to collect and interpret large exposure data sets. A clear collaboration agreement and transparency of the objectives of both parties is essential.

Abstract Number	**P-2-05-15**
Presenter	Peggy Reynolds*, Susan Hurley, Erika Garcia, Debbie Goldberg, Andrew Hertz, David O. Nelson
Exposure	ambient air pollution
Health domains	cancer
Type of research	cohort study

Hazardous air pollutants and risk of breast cancer among a cohort of California teachers

Background: While numerous hazardous air contaminants, many with widespread human exposure potential, have been shown to cause mammary tumors in animals, there is a dearth of human health evidence. Aims: The objective of this analysis was to estimate the risk of breast cancer associated with residential exposures to hazardous air pollutants (HAPs) in a large prospective study of female California teachers. Methods: The study population consisted of 112,380 members of the California Teachers Study (CTS) who had no prior history of breast cancer and lived at a geocoded California address at the initiation of the study in 1995. 5,025 cases of invasive breast cancer diagnosed 1996-2009 were identified through annual linkages to the California Cancer Registry. Estimated levels of HAPs were obtained from the U.S. EPA's 2002 NATA database and assigned to study participants' baseline addresses based on census tract. Age- and race-adjusted Cox proportional hazards models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) associated with 24 individual mammary gland carcinogens and a summary measure of total mammary gland carcinogens. Results: Women who lived in census tracts with higher concentrations of total mammary gland carcinogens had a significantly increased risk of breast cancer (highest tertile HR=1.08, 95% CI: 1.01 – 1.15, p-trend=0.028). Elevated risks were also noted for the individual compounds chloroprene (p-trend=0.045) and ethylidene dichloride (p-trend=0.037). Further adjustments for known breast cancer risk factors did not substantially change these results, although confidence intervals did become wider. Conclusions: These preliminary results suggest that living in areas with high levels of mammary gland carcinogens in ambient air may contribute to a modest increase in risk for breast cancer in women. Further analyses are required to estimate independent and joint effects of these highly-correlated individual compounds.

Abstract Number	**P-2-05-16**
Presenter	Ronald Wyzga*, Annette Rohr
Exposure	ambient air pollution
Health domains	other
Type of research	review

Health Efffects of Particulate Matter (PM) Components

Background: There is a general consensus among the scientific community that particulate matter (PM) composition plays a significant role in the health effects attributed to PM; there is some evidence that components may be more important than PM mass alone in explaining health responses. As information becomes available on the health impacts associated with various PM components, it is important to attempt to synthesize this information and place it in perspective. Aims: This presentation attempts to accomplish this for studies that relate PM and its components to acute health responses. Methods: We reviewed published studies that included at least two PM components and quantitatively assessed the relationship between the components and health effects. Results: Overall, the epidemiological studies did not exonerate any major component group of PM, but did demonstrate that carbon-containing PM components (elemental and organic carbon) are most strongly associated with adverse health outcomes. The results of controlled human exposure studies support this result, but there are only two such studies with published results. Toxicological studies generally considered elemental species in more detail and found that several trace elements, including aluminum, silicon, vanadium, and nickel, were most consistently associated with health impacts. Conclusions: Overall there are no PM components for which there is no evidence of adverse health effects. In studies of this nature, the results must be qualified because it is unclear whether a component per se is responsible for health impacts or is an index or surrogate for some other pollutant.

Abstract Number	**P-2-05-17**
Presenter	Camila M. Villegas Cintra*, Luciana D. M. Pastro, Lourdes C. Martins, Alfésio L.F. Braga, Silvia R.D.M. Saldiva, Rossana P.V. Francisco, Sandra E. Vieira, Paulo H.N. Saldiva, Luiz A.A. Pereira
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Impact of maternal exposure to nitrogen dioxide (NO2) during pregnancy on birth weight: a preliminary study in São Paulo, Brazil.

Air pollution exposure during pregnancy might have trimester-specific effects on birth weight. To evaluate the impact of maternal exposure to indoor, outdoor and individual NO2 concentrations during pregnancy on birth weight we have estimated the associations of maternal air pollution exposure with birth weight (BW) in 434 pregnant since 2011, in a São Paulo city District, Brazil. These pregnant women are recruited with gestational age less than 14 weeks. From the population-based prospective cohort aforementioned, we conducted a preliminary selection with 36 pregnant participants in a biomonitoring study. Indoor, outdoor and individual nitrogen dioxide (NO2) concentrations were quarterly measured with passive samplers. A questionnaire was applied to investigate maternal characteristics. Kolmogorov-Smirnov test was performed to assessing the normality of dependent variable (birth weight). Linear models were performed to associate potential maternal risk factors, NO2 measurement and BW, detecting the contribution of NO2 concentration to BW. None maternal risk factors (age, marital status, education, smoking, alcoholism,family income and ethnicity) showed statistical significance with BW and were not included in the final linear model with NO2 data. In the third trimester of pregnancy we obtained that the losing weight at birth was equivalent to 19.46g (95% CI -33.89 to -5.04) for each increase of 1 µg/m3 of outdoor NO2 concentrations. The analysis considering the indoor NO2 exposures, the weight at birth decreased 27.15g (95% CI -48.46 to -5.85) for each increase of 1 µg/m3 of indoor NO2 concentrations in the third trimester of pregnancy. Although not statistically significant, also in the third trimester, the each unit of individual NO2 measures shown to be related to a decrease of 8.45g in BW. The presented study suggests that exposure to NO2 during the last trimester of pregnancy contributes for decrease in BW.

Abstract Number	**P-2-05-18**
Presenter	Quentin Malloy, James Raymer, Cortina Johnson, Jocelin Deese-Spruil, Elizabeth Frey, Lisa Henry, Jonathan Thornburg*
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

Inhalation Exposure and Cancer: Linking Environmental and Biospecimen Samples

Southern Delaware in the U.S. is designated as a cancer cluster because of the elevated lung and bladder cancer rates in males. The cancer cluster is potentially related to lifestyle, quality of healthcare, and environmental factors. One environmental exposure factor is inhalation of particulate matter from indoor and ambient sources, where the ambient sources could be of local origin (coal-fired power plant) or from long-range transport. To assess a potential link between PM2.5 exposure and the cancer rates, a pilot study was developed to examine samples reflecting current regional, residential, and personal PM2.5 exposures along with biospecimen samples. Thirty-two participants were sampled over the course of a 4 week campaign in the fall seasons of 2011 and 2012. Ambient samples were obtained at one semi-rural background site and four sampling sites around the community. Participants had PM2.5 samplers placed outside and inside their homes and were also outfitted with the RTI MicroPEM for personal PM2.5 samples. The ambient PM concentrations measured at the fixed and outdoor residential sites were homogenous. The chemical speciation and back-trajectory analysis indicated the PM in the study area results from long-range transport from the Washington D.C. – Baltimore metro areas. Measurable quantities of carcinogenic metals in the PM2.5 were not found. Indoor and personal PM concentrations were dominated by tobacco smoke, which comprised 50% or more of the mass on a filter. Blood and urine samples found elevated levels of arsenic or selenium in 12 of the 32 participants. Our supposition that these potential carcinogens in the participants resulted from past exposures from local sources, tobacco smoke or dietary ingestion will be investigated further by analysis of the environmental, biospecimen, and survey data and, potentially, the collection and analysis of additional environmental samples.

Abstract Number	**P-2-05-19**
Presenter	Olivier Laurent*, Jun Wu, Lianfa Li, Scott Bartell
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Investigating the association between birth weight and complementary air pollution metrics in Southern California

Background Exposure to air pollution is frequently associated with reductions in birth weight but results of available studies vary widely, possibly in part because of differences in air pollution metrics. Aims To identify the air pollution metrics most strongly and consistently associated with birth weight. Methods A hospital-based obstetric database of 70,000 births in southern California (1997-2006) was used to study the relationships between complementary air pollution metrics (measurements from ambient monitoring stations, predictions from land use regression models and from a Gaussian dispersion model, traffic density, and proximity to roads) and 1) the risk of low birth weight (LBW, <2,500 g), and 2) birth weight (continuous variable). Associations were investigated using generalized additive models, adjusting for maternal age, parity, race/ethnicity, insurance status, poverty, gestational age and infant sex. Results Increased risks of LBW are associated with O3 measured by monitoring stations, traffic density and proximity to roads. LBW is not significantly associated with other pollution metrics, except that a decreased risk is associated with NO2 measured by monitoring stations. Small increases in mean birth weight are associated with most air pollution metrics. No such increase is observed for traffic density or proximity to roads, and a significant decrease in mean birth weight is associated with O3. Conclusions Results are contrasted depending on the pollution metrics examined. Unmeasured confounders and/or measurement errors might have produced spurious positive associations between birth weight and some pollution metrics. Despite this, O3 was associated with a decrement in mean birth weight and significant increases in the risk of LBW were associated with traffic density, proximity to roads and O3. This suggests that in our study population, these air pollution metrics are more likely related to increased risks of LBW than the other metrics

Abstract Number	**P-2-05-20**
Presenter	Morteza Seifi, Sadegh Niazi Esfyani, Hossein Arfaeinia, Masud Yunesian, Hassan Amini*
Exposure	ambient air pollution
Health domains	cancer
Type of research	cross-sectional study

Long-term air pollution exposure and childhood cancers in Tehran, Iran

Background: In addition to genetic factors, environmental factors, such as air pollution, may have a significant role in the etiology of childhood cancers (CCs). Aims: The aim of this study was to investigate the relationship of long-term air pollution exposure and CCs in Tehran, Iran. Methods: Records of 68 CCs patients in 2008 and 48 CCs patients in 2009 were obtained from Non Communicable Disease Center belong to Ministry of Health. Thereafter, they were successfully geo-coded within Tehran megacity by Geographic Information System (GIS) Bureau of Iran's Post Office based on their postal code. On the other hand, 189 random cases were created within the city by a GIS. The individual long-term exposure to sulfur dioxide (SO2) and particulate matter ≤ 10 µm (PM10) air pollutants of all CCs and random cases were estimated using land use regression models. Finally, bivariate correlations of the exposure of these groups were calculated. Results: The annual mean concentration of SO2 in the CCs and random cases in 2008 was 58 and 54 ppb, respectively. The annual mean concentration of PM10 in the CCs and random cases in 2009 was 87.1 and 94.4 µg/m3, respectively. The correlation of long-term exposure to SO2 in the CCs and random cases in 2008 was positive and significant (r = 0.37, p = 0.002). Meanwhile, the correlation of long-term exposure to PM10 between CCs and random cases in 2009 was positive and significant (r = 0.31, p = 0.035). No significant correlation was found for PM10 exposure in the CCs and random cases in 2008 and for the SO2 exposure in the CCs and random cases in 2009. Conclusions: We have found that childhood cancers are associated with long-term air pollution exposure.

Abstract Number	**P-2-05-21**
Presenter	Giulia Cesaroni*, Francesco Forastiere, Bert Brunekreef, Annette Peters, Cardiovascular working group Escape
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-Term Exposure to Ambient Air Pollution and Incidence of Coronary Events - Analysis of Eleven European Cohorts from the ESCAPE Project

Background Few studies have examined the risk of long-term exposure to airborne pollutants on the incidence of coronary events. Aims We studied the association between long-term exposure to ambient air pollution at residence and the incidence of coronary events in eleven cohorts participating in the European Study of Cohorts for Air Pollution Effects (ESCAPE, www.escapeproject.eu). Methods Cohorts enrolled in Finland, Sweden, Denmark, Germany, and Italy included a total of 100,166 subjects which were followed-up for an average of 11.5 years. We used Cox regression to evaluate the association between pollutants and incidence of coronary events adjusting for socio-demographic factors and smoking habit in each cohort separately. The exposure at residence was based on land use regression models for particulate matter <2.5 µm (PM2.5), 2.5-10 µm (coarse PM), <10 µm (PM10) in aerodynamic diameter, PM2.5 absorbance, nitrogen oxides, and traffic exposure. Meta-analyses were performed to pool cohort-specific results. Results A total of 5,157 subjects experienced incident coronary events. An increase of 10 µg/m3 in PM10 was associated with a Hazard Ratio [HR]=1.12 (95% confidence interval [CI]: 1.01-1.25). There was no evidence of heterogeneity across cohorts. Positive associations with other pollutants were also detected but were not statistically significant, for example an increase of 5 µg/m3 in PM2.5 was associated with a HR=1.13 (95%CI: 0.98-1.30). There was an increased risk for each 10 µg/m3 PM10 below the current annual European Limit Value of 40 µg/m3 (HR=1.12, 95% CI:1.00-1.27) and for each 5 µg/m3 PM2.5 below the Limit Value of 25 µg/m3 (HR=1.18, 95% CI:1.01-1.39). Conclusions This European multicenter study showed an association between exposure to particulate matter and incidence of coronary events which persisted at exposure levels below the current European Limit Values.

Abstract Number	**P-2-05-22**
Presenter	Steve Hankey*, Greg Lindsey, Julian D. Marshall
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Measuring and modeling particulate air pollution using a mobile, bicycle-based platform

Background: Air pollution concentrations exhibit significant within-city variability. Few studies use mobile measurements to estimate land-use regression models. Aim: To develop land-use regression models of particulate air pollution using a bicycle-based, mobile sampling method. Methods: We measured particulate air pollution during morning (7-9am; n=12 days) and afternoon (4-6pm; n=30 days) rush hours on weekdays (8/14 – 10/16/2012). Measurements were performed using a mobile platform. Our modified bicycle trailer contained equipment to measure: (1) particle number concentration, (2) PM2.5 mass concentration, (3) black carbon concentration, and (4) particle size distributions. Three sampling routes (~20 miles each) were cycled repeatedly (10 [4] times per route in the afternoon [morning]) to estimate typical rush hour concentrations in urban environments throughout Minneapolis, MN. Results: Our results are in mainly two categories: (1) correlates of the built environment and particulate air pollution and (2) land-use regression models to estimate concentrations of air pollution during rush hour for street segments in Minneapolis. We found particulate air pollution concentrations are related to aspects of the built environment, for example, mean particle number concentration varies by street classification: 19,009 pt/cc (arterials), 18,374 pt/cc (collectors), 14,059 pt/cc (local), and 13,186 pt/cc (off-street trails). In general, particle number concentrations were 1.9× higher during morning rush hour (mean: 31,043 pt/cc) than during afternoon rush hour (mean: 16,312 pt/cc). Policy implications: Our results demonstrate mobile-monitoring land-use regression, and inform efforts to reduce air pollution exposures and plan for health-promoting non-motorized transportation.

Abstract Number	**P-2-05-23**
Presenter	Annunziata Faustini*, Regula Rapp, Francesco Forastiere
Exposure	ambient air pollution
Health domains	other
Type of research	meta-analysis

Nitrogen dioxide and mortality: review and meta-analysis of long-term studies

Background. Exposure to nitrogen dioxide (NO2) has been linked to increased mortality in several epidemiological studies on both short and long-term effects. The question whether NO2 is directly responsible for the health effects, or it is only an indicator for other pollutants (mainly particulate matter) remains to be assessed. Aim. We have reviewed the more recent studies evaluating the long-term effects of NO2 on mortality to provide a quantitative summary of the effects potentially useful for health impact assessment. Methods. Original studies exploring the relationship between long-term NO2 exposure and mortality, and including also PM effects, were searched in PubMed, Web of Science and LUDOK. Twenty-seven papers published in 2004-2012 were selected. A meta-analysis was carried out on 19 studies, with different study design, estimating random effects relative risks. Results.The pooled effect on mortality was 1.05 (95% confidence intervals = 1.02-1.07) for 10µg/m3 of NO2 annual concentration. The corresponding effect for PM2.5 (10µg/m3) was 1.05 (95%CI=1.03-1.08). The effect on cardiovascular mortality (CV) was 1.14 (95%CI=1.10-1.19) for NO2 and 1.22 (95%CI=1.10-1.35) for PM2.5. The NO2 effect on respiratory mortality was 1.03 (95%CI1.02-1.03), whereas the effect of PM2.5 was 1.05% (95%CI 1.004-1.104). The five carried-out bi-pollutant analyses showed no changes of NO2 effects in comparison to the single-pollutant estimates. The NO2 effects were stronger in Asia and Europe than in North America. Conclusions.There is evidence for a long-term effect of NO2 on natural mortality as high as that of PM2.5. An independent effect of NO2 emerged, though explored only in few studies. The associations of NO2 with mortality differed across the areas of the world.

Abstract Number	**P-2-05-24**
Presenter	Lucia Fazzo*, Simona Menegozzo, Maria Eleonora Soggiu, Marco De Santis, Michele Santoro, Valentina Cozza, Amelia Brangi, Massimo Menegozzo, Pietro Comba
Exposure	others
Health domains	cancer
Type of research	health impact assessment

Pleural mesothelioma incidence in the population resident close to an asbestos-cement industry located in an Italian polluted site

BACKGROUND. The industrial area of “Bagnoli Coroglio” in Naples municipality was defined as a “polluted site of national concern for remediation” in 2000. A steel and a cement plants and an asbestos-cement (Eternit) and a chemical industries operated in the area. AIMS. To estimate pleural mesothelioma incidence in the districts of Naples around the industrial area. METHODS. The area potentially affected by the industrial emissions was identified by modelling; environmental asbestos exposure was categorized in two levels: higher in subarea 2 and lower in subarea 1. Cases of pleural mesothelioma (2001-2007) were mapped according to residence at diagnosis; those included in the occupational cohorts of the asbestos-cement and steel plants and those with ascertained occupational exposure in the Mesothelioma Registry were excluded. Standardized Incidence Ratios (SIRs) were computed for overall area and subareas with respect to municipal rates. RESULTS. At 2001 census 157,495 subjects lived in the study area; 12 women and 34 men of them had a diagnosis of pleural mesothelioma (2001-2007). A significant increase was observed among men in the overall study area (SIR=1.89) and in subarea 1 (SIR=2.04). Among women in both subareas the increases were not significant. A not significant Risk Rate of 1.15 was observed in women of subarea 2 with respect to subarea 1. CONCLUSIONS. In the territory close to the industrial area increased pleural mesothelioma incidence (statistically significant among men and not significant in women) was found. In the subarea with a higher estimated asbestos exposure, SIR was not significantly increased, but a risk ratio higher than 1, based on 3 observed cases, was found in women with respect to the other subarea. Two of these 3 women were less than 50 years old. Despite the low power, the study indicates a possible impact of environmental asbestos exposure in the population resident close to an asbestos-cement industry.

Abstract Number	**P-2-05-25**
Presenter	Francesca Mataloni*, Massimo Stafoggia, Ester Rita Alessandrini, Maria Triassi, Annibale Biggeri, Francesco Forastiere
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

POPULATION COHORT STUDY TO EVALUATE THE HEALTH EFFECTS OF ENVIRONMENTAL AND OCCUPATIONAL EXPOSURES

Background: the area of Taranto in Southern Italy has been investigated in several environmental and epidemiological studies because of a large steel industry operating since the 1960's. Excesses of mortality and cancer incidence were found in the local population, but the studies were mostly ecological, and did not consider the potential confounding effect of socioeconomic status (SES) or occupational exposures. Aims: we applied a cohort study design to evaluate cause-specific mortality and hospitalization in relation to PM10 exposure levels from the industry and occupational exposures. Methods: a cohort of residents (1998-2010) was enrolled. Industrial PM10 concentration (SPRAY dispersion model) was assigned to each participant on the basis of the geocoded addresses at the beginning of the follow-up. Individual occupational history was traced through the national insurance company (INPS) database. Several exposures were considered: districts of residence, SES, PM10 and occupational history (workers in steel, naval and mechanical construction factories vs others). Mortality/morbidity information were retrieved from Regional Health Databases. The associations between exposures and mortality/morbidity were estimated using multivariate Cox models. Results: 321,356 people were enrolled in the cohort. Higher mortality/morbidity risks were found for people with a low SES and resident in districts close to the industrial area. PM10 exposure (10 µg/m3) was associated with an increase risk of death from cardiac diseases (HR=1.04 95%CI 1.01-1.07), in particular acute coronary events (HR=1.09 95%CI 1.01-1.18) and respiratory hospitalizations (HR=1.08 95% CI 1.05-1.10). Workers in the steel plant (13,556 individuals) had an increased mortality for stomach, bladder and pleural cancer and increased hospitalization for cardiovascular and respiratory diseases. Conclusions: Exposure to PM10 from the industry and employment in the steel industry were associated with increased mortality/morbidity.

Abstract Number	**P-2-05-26**
Presenter	Lenie van Rossem*, Steven Melley, Sheryl Rifas-Shiman, Antonella Zanobetti, Brent A. Coull, Joel D. Schwartz, Murray A. Mittleman, Emily Oken, Matthew Gillman, Petros Koutrakis, Diane R. Gold
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Prenatal Exposure to Air Pollution and Newborn Blood Pressure

Background: Air pollution is associated with blood pressure (BP) in adults. However, little is known about its influence on newborns, whose mothers may be exposed to pollution during gestation, a critical period for somatic and cardiovascular growth and development. Aims: To examine the associations of prenatal exposure to black carbon (BC) and ozone (O3) with newborn systolic BP. Methods: We studied 1,131 mother-infant pairs in Project Viva, a prospective birth cohort. We calculated moving average exposures by trimester and during the 1-7, 14, 30, 60 and 90 days before birth for BC and O3 measured at the Harvard Air Pollution Supersite (temporal); and residence-level estimated BC (spatiotemporal). We measured newborn BP (mmHg) up to 5 times with an automated device and used mixed effect models to estimate the association between the two air pollutants and BP. Estimates represent the difference in blood pressure for exposure between the 25th and 75th percentile of air pollution. Results: Mean (SD) systolic blood pressure in newborns was 72.5 (9.0). Mean maternal age was 32.0 (5.3) years, 67% completed college, and 31% was non-White. In models adjusted for child's state during measurement, sequence number of the measurement, mother's age, neighborhood socio-economic position, mother's 3rd trimester BP, birth weight, season, and a long-term time trend, higher BC exposure in the 3rd trimester was associated with higher newborn BP (for each inter-quartile increase: bspatiotemporal: 1.29 mmHg, 95% CI: 0.48, 2.11; btemporal: 1.81 mmHg, 95% CI: 0.48, 3.14). In contrast, higher exposure to O3 in the 3rd trimester and in the 30 days prior to birth was associated with a lower BP (-3.99 mmHg; 95% CI: -6.23, -1.75). BC and O3 exposures in the 1st or 2nd trimester was not associated with newborn BP. Conclusion: Maternal exposures to BC and O3 during gestation have opposing associations with newborn BP. It is not known whether these associations persist into later childhood.

Abstract Number	**P-2-05-27**
Presenter	Mihkel Pindus*, Hans Orru
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Proximity of busy road increases the prevalence of heart disease – results from RHINE Tartu cohort

Background: Exposure to traffic-related pollutants such as nitrogen oxide, exhaust and coarse particles has been associated with cardiovascular and respiratory diseases. Living close to major road could cause many health problems such as asthma, allergic sensitization, wheezing, rhinitis etc. Number of studies has shown that many people in different Europe cities live within 250 m buffer zone with more than 10,000 vehicles per day. With GIS systems we have opportunities to study the associations between environmental exposure and disease symptoms using spatial linking of different types of data. Aim: Current study aimed to determine if living near a busy street increases the odds of heart diseases and respiratory complaints in Tartu Respiratory Health in Northern Europe (RHINE) cohort. Methods: As part of RHINE study, a questionnaire was sent in 2000/2001 Tartu RHINE cohort to 2460 respondents (69% response rate). Home addresses were geocoded and traffic data where obtained based on annually conducted traffic counts in Tartu. The distance to busy road section from respondents home were found using ArcGIS. The associations between proximity to busy street and self-reported heart diseases and respiratory symptoms were found using an adjusted logistic regression model. Results: Appeared that living closer than 150 m from busy street (>10,000 vehicles per day) has significant odds 1.63 (95% CI = 1.05–2.54) of having cardiac diseases. It`s even higher 1.81 (95% CI = 1.01–3.24) if living closer than 75 meters. Also we found high odds 1.51 (95% CI = 1.00–2.27) of having shortness in breath if living closer than 150 m with >8,000 vehicles per day (around 20.0 % of respondents lived within 150 m zone with traffic >8,000 per day). However, we did not see significant relationship with other studied respiratory symptoms such as wheezing, cough, chronic bronchitis, rhinitis, chest tightness and asthma. Conclusions: The study showed that traffic-related air pollution has significant effect of causing heart diseases and shortness of breath.

Abstract Number	**P-2-05-28**
Presenter	Nicole C. Deziel, Rudolph P. Rull, Joanne S. Colt, Catherine Metayer, Peggy Reynolds, Todd P. Whitehead, Robert B. Gunier, Patricia A. Buffler, Mary Ward*
Exposure	household air pollution
Health domains	cancer
Type of research	case-control study

Residential Exposure to Polycyclic Aromatic Hydrocarbons and Risk of Childhood Acute Lymphoblastic Leukemia

Background/Aim: Several polycyclic aromatic hydrocarbons (PAHs) are known or probable human carcinogens. We evaluated the relationship between PAH exposure and risk of childhood acute lymphoblastic leukemia (ALL) using levels in carpet dust as an exposure indicator. Methods: We studied 251 ALL cases 0-7 years of age and 306 birth certificate controls matched on age, sex, and race/ethnicity from the California Childhood Leukemia Study. From 2001-2007, we collected carpet dust using a high volume surface sampler (HVS3) (n=185 cases, 212 controls) or by sampling dust from participants' used vacuum cleaner bags (n=66 cases, 94 controls). We measured concentrations of 9 PAHs in the dust, computed the sum and the sum weighted by the relative potencies of each PAH (the toxic equivalence [TEQ]). Odds ratios (ORs) were calculated using logistic regression adjusting for demographics, time between diagnosis/reference date and dust collection, and season of dust collection. Results: Among participants with HVS3 dust, there was no association between individual or summed PAH concentrations or the TEQ and ALL risk. Among those with vacuum dust, we observed elevated odds ratios (OR [95% Confidence Intervals]) with each log (ng/g) increase in concentrations of benzo(a)pyrene (1.5 [0.97-2.3]), benzo(k)fluoranthene (1.8 [0.94-3.6]), indeno(1,2,3-cd)pyrene (3.0 [1.1-3.7]), dibenzo(a,h)anthracene (2.7 [1.4-5.3]), and the TEQ (2.9 [1.4–6.1]), but not the summed PAHs. Differences between dust sample types did not appear to be due to seasonal, temporal, or spatial variation. HVS3 samples were collected from a single room where the child spent the most time, while the home vacuum was likely used in many rooms over a longer time period. Conclusions: Though we found no association between PAH levels in dust and ALL risk among participants with HVS3 dust, the increased risk observed in the smaller subset with dust collected from the home vacuum warrants further exploration.

Abstract Number	**P-2-05-29**
Presenter	Mariam Girguis*, Scott Bartell, Veronica Vieira
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Spatio-temporal Associations Between Birth Defects and Distance to Road

Background: Risks of birth defects may vary spatially and temporally due to maternal factors, neighborhood characteristics, or exposure to environmental contaminants. Aims: This study uses generalized additive mixed models (GAMM) to explore the spatio-temporal associations of neural tube, cardiovascular, and oral cleft defects with distance to road while adjusting for individual and communtiy-level factors. Methods: We analyzed 3210 cases of cardiovascular defects, 807 cases of oral cleft defects, and 313 cases of neural tube defects among infants born in Massachusetts USA from 2000 to 2007. For each of the 3 birth defect groups, we applied a geographically stratified control sampling scheme to select 10,000 control births using the MapGAM package in R that oversamples geocoded birth addresses in areas of lower population density. We then weighted the smooth term in the GAMM analyses to account for the geographically stratified sampling. Covariates included infant's sex and race/ethnicity; maternal education, smoking, drinking, age, language preference; prenatal care, pregnancy risk factors, complications during labor and delivery; payer source; and paternal occupation. GIS was used to calculate the distance to the nearest major road as a proxy for traffic pollution exposure. The GAMMs provided state-wide crude and adjusted odds ratios (ORs) used to construct movie frames to visualize risk continuously over space and time. Results: Key findings included statistically significant areas of increased risk of neural tube birth defects that was slightly attenuated by maternal education and age. There were weak associations between risk of cardiovascular malformations and proximity to roadways with ORs ranging from 1.1-1.4 with increasing risk from west to east. Conclusions: Geographically stratified control sampling allowed us to overcome the common limitation of low population density in our analyses. Our results suggest a possible association between distance to road and cardiovascular birth defects but further analyses are needed.

Abstract Number	**P-2-05-30**
Presenter	Hanne Krage Carlsen*, Thorarinn Gislason, Haraldur Briem, Gudrun Petursdottir
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Symptoms following exposure to the Eyjafjallajökull volcanic eruption – at the eruption's end and six months later

Background The 2010 Eyjafjallajökull eruption in Iceland spring dispersed fine grained ash over South Iceland. It also posed an opportunity to study health effects of a volcanic eruption in a modern society with strong infrastructure. The aim of the study was to evaluate the health of an exposed population exposed to the active eruption and 6 months after its end, compared to a control population. Methods Towards the end of the eruption, very exposed adult South Icelanders underwent a health check, and six months later, exposed South Icelanders and a control group answered questionnaires about recent physical symptoms, underlying disease and their exposure. Results At the eruption's end, 167 adults participated in the health check, where no serious health outcomes that could be associated with the eruption were found. 1148 South Icelanders and 510 controls answered the questionnaires. Demographics and rates of underlying disease were similar in the groups. For most recent irritation symptoms, prevalence was highest in the most exposed at the end of the eruption, followed by the prevalence in the most exposed after 6 months, lower in the control group or the least exposed of the south Icelanders, e.g. cough were reported by 57% of the most exposed during the eruption, 19% six months after the eruption ended, and by 6% of the control population. There was a similar pattern for mental unhealth, the proportion was 39% among the most exposed at the end of the eruption, 26% six months later, and 19% in the control population. Conclusion Presenting results from the two studies of high exposure to the Eyjafjallajökull eruption we found that many symptom rates were higher during the eruption, while subsiding after a six months period, though still elevated compared to controls.

Abstract Number	**P-2-05-31**
Presenter	Yi-Chun Chen*, Yu-Li Huang, Yu-Kang Chang, Fung-Chang Sung, Yu-Chun Wang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

The association between air pollution and lung function in Children

Background: Various studies have found respiratory impacts on adults from exposures to air pollutants in earlier stages of life. The relationships between respiratory illnesses and air pollution were examined largely with single air pollutant, but the combined effects from multiple air pollutants remained unclear. Aims: This study evaluated the association between children's lung function and various air pollutants. Methods: Forced vital capacity (FVC) and forced expiratory flow in one second (FEV1) were measured from 2,919 students aged 12-16 in a mass screening program for asthma in Taiwan. Daily concentration records for PM10, SO2, CO, NO2 and O3 were collected from five ambient air quality monitoring sites in Taipei City. Principal component analysis was performed to extract components to express air pollution level because of high correlation between CO, SO2, NO2 and PM10 (Pearson's correlation r>0.5). Two components, the "original air pollutions" and "secondary air pollutions" were constructed. The combination of "original air pollutions" was 0.88SO2+0.93CO+0.93NO2-0.32O3+0.78PM10; the combination of "secondary air pollutions" was 0.16SO2-0.10CO-0.18NO2+0.92O3+0.51PM10. The association of FVC and FEV1 with the two extracted components were determined and adjusted for age, gender, height, weight, students' living district, temperature, and rainfall. Results: The mean of FVC and FEV1of all students was 3.26L and 2.98L, respectively.Ranges of Measurements of SO2, CO, O3, PM10 and NO2, respectively, were 1.8-10.0 ppb, 0.60–2.10 ppm, 10.7–30.5 ppb, 35.3–98.3 ug/m3 and 16.2–49.3 ppb. Negative association was found between "secondary air pollution" and FVC and FEV1: a unit increase of "secondary air pollution" was associated with reduction of 40.26 mL (95% CI: -69.64, -10.88 mL) in FVC and 29.84 mL (95% CI: -58.00, -1.68 mL) in FEV1. Conclusions: Exposure to secondary air pollution was negative associated with FVC and FEV1.

Abstract Number	**P-2-05-32**
Presenter	Alina Vodonos*, Michael Friger, Itzhak Katra, Helena Krasnov, Victor Novack
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

The impact of acute exposure to desert dust on hospitalizations due to acute coronary syndrome. Gender effect.

Background: Recent studies show an association between urban air pollution and cardiovascular diseases, but the understanding of impact of acute exposure to particulate matter (PM) originating from dust storms in an arid urban environment is limited. Trends of desertification and climate change pose a significant health problem increasingly exposing world population to desert dust storms. The Negev area (Israel) situated within one of the largest dust belt offers an opportunity to investigate the effect of desert dust on the human health. Aims: To assess the impact of acute exposure to PM dust particles on frequency of acute coronary syndrome (ACS) hospital admissions. Methods and statistical analysis: Patients admitted to Soroka University Medical Center during 2001-2010 with a primary diagnosis of ACS. Data on temperature, relative humidity and daily concentration of PM10, and co-pollutants (NO2, SO2, O3, and CO) were obtained. Dust storm days were defined by PM10 greater than two standard deviations above the background values. We performed time series analysis using GLM and GAM models, to assess the ACS incidence rate ratio (IRR) controlled for meteorological, seasonal factors and other pollutants. Results: We identified 17,024 admissions of 10,802 patients with the primary diagnosis of ACS. 68.4% were male and average age was 66±13.3 years, 30.2% had diabetes, 59% dyslipidemia and 50.1% hypertension. A short-term increase in hospital admission rates was found during the dust storm days in female patients (IRR=1.16 95%CI 1.06-1.25, p<0.01) but not in male patients (IRR=0.96 95%CI 0.91-1.02, p=0.19). This difference between the genders remained significant in sub-analysis of patients older than 70 years. Conclusion:It appears that health risk associated with the non-anthropogenic PM10 exposure is gender specific. Further investigation is needed to understand the role of these natural events, particularly among the vulnerable population groups.

Abstract Number	**P-2-05-33**
Presenter	Takeshi Kochi*, Satoko Iwasawa, Tazuru Tsuboi, Makiko Nakano, Takamoto Uemura, Shigeru Tanaka, Kazuyuki Omae
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

The relationship between sulfur dioxide exposure and the health of adult Miyakejima residents

Background: Mt. Oyama, Miyakejima, began to erupt in June 2000, and the island was evacuated. Volcanic gas emissions, composed primarily of sulfur dioxide (SO2), gradually decreased, and residents returned to the island after the evacuation order was lifted in February 2005. Aims: In this study, the effects on residents' health from the exposure environment following lifting of the evacuation order in February 2005 were investigated first in February 2006 and then in each November from 2006 to 2011. The relationship between the amount of exposure to SO2 and the health effects was studied in adult Miyakejima residents. Methods: The subjects of this study were registered residents aged 18 and above at the time of each medical checkup. A total of 4,089 checkups were conducted. The mean values and percentage of 0.10 ppm or more hourly values were sought from 81 months of exposure concentration data. Health effects were evaluated through pulmonary function tests and the self-administered questionnaire. Results: There were significant differences in %FVC and %FEV1 observed in a comparison of pulmonary function by area. However, there was no significant difference observed in the same comparison over time. In the context of exposure concentration, a significantly higher proportion of persons with an increased frequency of cough and phlegm symptoms was observed in areas with an annual mean SO2 concentration of around 40 ppb or above when compared with residents in areas with a minimal exposure concentration. In addition, there was a significant increase in throat, nose, eye and skin symptoms in areas where the annual mean SO2 concentration exceeded about 10 ppb. Conclusions: Follow-up observation should be continued, with a focus on the relationship between the amount of exposure to SO2 and health effects.

Abstract Number	**P-2-05-34**
Presenter	Bénédicte Jacquemin*, Valérie Siroux, Margaux Sanchez, Anne-Elie Carsin, Anna Hansell, Anna Buschka, Christophe Declercq, Tamara Schikowski, Nino Kuenzli, Francine Kauffmann
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	meta-analysis

Traffic related air pollution and adult asthma incidence: the European Study of Cohorts for Air Pollution Effects (ESCAPE)

Background: The role of air pollution in the development of adult onset asthma remains uncertain. The objective was to assess the impact of long-term exposure to traffic related air pollution on adult onset asthma in six previously established European cohorts (ECRHS, EGEA, E3N, NSHD, SALIA, SAPALDIA) using the newly developed and standardized ESCAPE exposure estimates. Methods: Annual concentrations of NO2, NOx, PM2.5, PM10 and PM_coarse and traffic exposure at the home addresses were estimated using land-use regression models. In each cohort, logistic regression models were adjusted for age, sex, BMI, education and smoking. Cohort-specific results were meta-analysed. Results: In total, 23'701 subjects with NO2 and 16'662 subjects with PM annual concentration estimates were available from the six cohorts. We observed 1,257 cases of incident asthma, with asthma incidence rate varying between 2.9 and 8.3 per year per 1,000 subjects in SAPALDIA and EGEA respectively. In the meta-analyses, the associations between air pollution and asthma incidence were not statistically significant (OR: 1.05 (95%CI: 0.97,1.14) per 10µm/m3of NO2 and 1.04 (95%CI: 0.88,1.22) per 10µm/m3 PM10). We did not either observe statistically significant associations with the traffic indicators OR: 1.04 (95%CI: 0.97,1.12) per 5000 vehicles/day on the nearest road and 1.05 (95%CI: 0.86,1.29) per 4 million vehicles/day on major roads in a 100m buffer. Conclusion: This meta-analysis did not show statistically significant associations between traffic exposures and adult onset-asthma, with point estimates lower than the ones already published. Further analyses will be needed to address the rather substantial time difference between exposure measurements taken as part of ESCAPE, using back-extrapolated exposure data, and the health assessment of the original studies, as well as the limitations in exposure contrasts or precision in the exposure models. Acknowledgments: ESCAPE EC-FP7-GA 211 250

Abstract Number	**P-2-05-35**
Presenter	Elaine Hill*
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania

Background: Due to increased natural gas wellhead prices, hydraulic fracturing has become a prevalent method for extracting natural gas from shale formations around the United States. Over the last decade, 31 states have begun using this technology. There are numerous environmental and health concerns related to this technology, but to date, there is no study that has been able to link hydraulic fracturing with human health. Aims: This research exploits the introduction of hydraulic fracturing in natural gas wells to identify the impacts of potential air pollution and water pollution on infant health. Infants do not have a lifetime of exposure to toxic chemicals to control for and so we focus on infant health measures as our outcomes of interest (low birth weight, prematurity, birth weight, gestation and APGAR scores). Methods: Using detailed vital statistics, exposure is defined by close proximity to a well head prior to birth. The difference-in-differences design utilizes the unique retrospective data of drilled wells and permitted wells and compares birth outcomes for mothers who live within 2.5 km of a drilled well to mothers who live within 2.5 km of a future well (permitted). Results: When utilizing a difference-in-differences estimator, the results suggest that infants born to mothers who live within 2.5 km of a drilled well prior to birth weigh less and are more likely to be both low birth weight. Little impact on premature birth or gestation period is detected. Conclusions: Exposure prior to birth to unconventional natural gas development has adverse effects on infant health at birth for mother's residences within 2.5 km of a well head.

Abstract Number	**P-2-05-36**
Presenter	Otgon Galsanjav*, Otgon Galsanjav
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

URBAN AIR POLLUTANT AND BLOODS PARAMETERS OF CHILDREN

Urban Air pollutant and bloods parameters of children G.Otgon, HSUM Background: Air pollution is a significant risk factor for multiple health conditions.The air pollution of Ulaanbaatar are increasing in the last time. Because very important to study the air pollution and health of population. Aim of the study:To study the influence of air pollution Ulaanbaatar's on the children's health. Method's:We did retrospective descriptive analyses data of sulfur ioxide (SO2), nitrogen dioxide (NO2), carbon dioxid (CO), measured at the monitoring stations throughout Ulaanbaatar, Government agencies, Ministry of nature and environment, Mongolia during from 1989 to 2011. SO2, NO2, CO are measured as average 24h and year. Air pollution are measured with the the air quality index(AQI). Use microscopic examination of blood films. We analyzed 947 (boy- 429, girl - 518)relatively health children's aged 2-17 years. Results:Are increasing air pollutant's, as sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon dioxid (CO) year by year, in winter. AQI are measured SO2-190, NO2-220,CO-120, (at 2006 year), SO2-230-360,NO2100-250 (2009-2011year), that shows air pollution of Ulaanbaatar is hazardous. The erythrocyte of blood bois aged 2-8 year old are low, than girls. Erythrocyte girls decreased at 12-13 year old, than bois. Content of hemoglobin bois decreased still 11 year old, than girls and it was low 12-17 aged girls, than bois. Revealed correlation erythrocyte of bloods bois and girls and factor's, as SO2(r=-0.6)иNO2(r=-0.3). Also was correlation bloods hemoglobin with factors, as SO2 (r=-0.6, r=-0.8), and withNO2(r=-0.3). Conclusion: Influenced air pollutant, such as atmospheric SO2,NO2 and CO on parameters of ''red'' blood children's.

Abstract Number	**P-2-05-37**
Presenter	Kazuhiko Ito*, Zev Ross, John Freese, James Braun, George Thurston, David Prezant, Robert Silverman
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Weather, air pollution, and out-of-hospital cardiac arrest in New York City, 2007-2010

Background: Past studies to investigate the impacts of weather and air pollution on out-of-hospital cardiac arrest (OOHCA) have shown inconsistent results. Our previous analysis of the 2002-2006 data in New York City showed that ambient fine particulate matter (PM2.5) was associated with OOHCA (DOI: 10.1093/aje/kwq217). Aims: To investigate the impacts of weather and air pollution on OOHCA cases in NYC in more recent years (2007-2010). Methods: We analyzed 12,383 OOHCA cases of primary cardiac etiology collected from May 2007 to September 2010 by the New York City Fire Department/Emergency Medical Services. Time-stratified case-crossover analysis was conducted to estimate the short-term effects of daily average temperature, citywide daily average values of PM2.5, ozone, nitrogen dioxide, carbon monoxide, and sulfur dioxide at lag 0 through 3 days in all-year, warm (April-September) and cold (October-March) periods. Temperature was modeled using both natural splines and quintile indicators for possible non-linear association. Results: Air pollution levels have generally declined (e.g., 25% for PM2.5; 40% for sulfur dioxide) compared to the previous period, except for ozone. Their risk estimates generally declined and were not significant, though ozone's risk estimate remained similar to that in our previous analysis, with a 4.5% excess risk (95% confidence interval: -1.7, 11.2) per 20 ppb 0- and 1-day lag average of 8-hr daily maximum ozone. The most consistent and significant association was with 3-day lagged temperature in the cold season, with a 12% excess risk (95%CI: 4.6, 20.6) for the coldest quintile of temperature. Conclusion: Declining air pollution levels may explain reduced associations between air pollution and OOHCA in this city. The lagged cold temperature effect on OOHCA is consistent with the results from the studies that examined cold temperature and cardiovascular mortality.

Abstract Number	**P-2-05-37**
Presenter	Roman Jandarov, Lianne Sheppard, Vedal Sverre, Adam Szpiro*
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

A novel principal component analysis for spatially-misaligned multivariate air pollution data

Background: Analysis of health effects of multi-pollutant, long-term air pollution exposure poses two challenges. First, monitoring data are typically spatially misaligned, so it is necessary to predict multiple exposure surfaces using spatial models. Second, parameter estimates from a health effect model with many pollutants can be difficult to interpret. These challenges motivate a dimension reduction strategy in which the multi-pollutant exposure is approximated by a linear combination of principal components. Dimension reduction can be carried out in a sequential two-step process in which principal components are first derived based on monitoring data, and then the corresponding scores are predicted at subject locations, also based on monitoring data. The problem with this approach is that it may lead to principal components that are difficult to predict at unmeasured locations. Methods: We propose a novel approach for dimension reduction in multivariate spatial data. We seek to find sparse principal components that explain a large proportion of the variance in the data while also ensuring that mixtures derived from these components are predictable at unmeasured locations. We provide an efficient implementation of our method and compare it with alternative dimension reduction approaches. We illustrate our approach by applying it to national multi-pollutant air pollution data from the U.S. Environmental Protection Agency and an analysis of the association with blood pressure in the NIEHS Sister Study. Results: Our methodology is able to identify interpretable sparse principal components that explain a significant proportion of the observed variability in multi-pollutant monitoring data and are also well predicted at unmeasured locations. Prediction accuracy is notably improved compared to the alternative two-stage approach. The results of applying our method to air pollution and blood pressure are pending.

Abstract Number	**P-2-06-01**
Presenter	Olga Costa, Elena López-Villarrubia, Carmen Iñiguez, Ferran Ballester*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Association between Saharan dust days and emergency hospital admissions in Canary Islands

Background The proximity of the Canary Islands to the Northwestern Coast of Morocco (100km) and the regional atmospheric circulation result in an ideal scenario for the transport of African dust from Sahara and Sahel regions towards Canary Islandas. This phenomenon is known as "Saharan dust intrusions". These intrusions can last for one or more days (episodes), reaching occasionally daily average levels higher than 600 µg/m3 of PM10 and 250 of PM2.5. Aims The aim of this study was to analyze in detail the short-term association between days with Saharan dust intrusions (Saharan dust days, SDD) and morbidity in the cities of Las Palmas de Gran Canaria (LPGC) and Santa Cruz de Tenerife (SCTF) Methods From 2001 to 2005 the association between SDD and daily emergency hospital admissions for respiratory and circulatory diseases was examined using Generalized Additive models adjusting for potential confounders. The effect of concurrent SDD and polynomial distributed lag models [PDLM]) were assessed. Two main types of Saharan dust intrusions over the islands (low and high altitude atmospheric intrusions) were also studied separately Results The number of episodes were 133 in LPGC and 142 in SCTF (561 and 591 SDD respectively). A SDD associated with a 22.6% increase (95% CI 10.4, 36.0) and 29.9% (6.6, 58.4) in risk of all respiratory and COPD admissions respectively in SCTF during the concurrent and the 5 consecutive days. Low altitude atmospheric dust days significantly associated with all respiratory 12.0% (2.7, 22.4) and COPD, 22.7% (4.7, 43.8) in SCTF and with asthma in LPGC: 31.3% (0.9, 70.8). Conclusions We found a short term impact of SDD on emergency hospital admissions for respiratory diseases in both cities that spread over several successive days and that are higher in low altitude atmospheric intrusions. Preventive actions and preparedness plans must be developed for public health protection from these natural events.

Abstract Number	**P-2-06-02**
Presenter	Hind Sbihi*, Ryan W. Allen, Allen Becker, Diana Lefebvre, Piush Mandhane, Malcolm R. Sears, Padmaja Subbarao, Stuart E. Turvey, Michael Brauer
Exposure	ambient air pollution
Health domains	allergies
Type of research	cohort study

Atopy at age 1 and traffic-related Air pollution: an investigation of exposure measures in the Canadian Health Infant Longitudinal Development (CHILD) birth coh

Background: The evidence for increased risk of sensitization in children due to traffic related air pollution (TRAP) exposure is equivocal and information from birth cohorts with spatiotemporal exposure assessment is rare. Aims: We used atopy data at age 1 from an ongoing birth cohort (CHILD) and land use regression (LUR) estimates of individual exposure to nitrogen dioxide (NO2) to examine the association between TRAP and sensitization in four Canadian cities. Methods: We identified 885 children who were ≥ one year old on July 31st, 2012 and with measurement of atopy for inhalant (Alternaria, Der p, Der f, Cat, Dog, Cockroaches) and food-related allergens (soybean, milk, peanuts, eggs). Participants with epicutaneous skin test 2mm greater than negative control were defined as atopic.Exposure was estimated from city-specific LUR models with and without bi-weekly temporal adjustment based on fixed-site monitoring network data. We examined sex, study center, SES, maternal smoking/atopy/asthma, siblings, pets, mold, and secondhand smoke exposure as covariates. Those showing significant associations with atopy were offered in mixed models evaluating TRAP exposure during pregnancy and the first year of life. Results: Within-city contrasts in TRAP exposure in utero and during the first year of life was positively associated with sensitization to inhalant allergens at age one (adj. OR [95%CI]: 2.16 [1.17 -4.04], 2.15[1.21 -3.71] per 10 ppb increase, for in utero and year 1, respectively). Temporal adjustments of LUR estimates led to increased odds ratios for both time windows with a more pronounced effect during the first year of life (2.6 [1.4 -4.8] and 3.3 [1.7 – 6.7], for in utero and year 1, respectively). Conclusion: Early-life TRAP exposure was associated with risk of sensitization. Increased specificity in exposure assessment increases effect estimates.

Abstract Number	**P-2-06-03**
Presenter	Nadine Kubesch*, Audrey Audrey de Nazelle, David Martínez, Laura Bouso, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	case-crossover study

BRAIN-DERIVED NEUROTROPHIC FACTOR (BDNF) SERUM LEVELS POST EXPOSURE TO TRAFFIC RELATED AIR POLLUTION AND INTERDEPENDENCIES WITH PHYSICAL ACTIVITY

Background: BDNF is assumed to improve cognitive function. Traffic related air pollution has been shown to reduce the exercise induced BDNF release. Aims:We aimed to study the BDNF levels in a healthy population in Barcelona following short term exposures to traffic air pollution under real world conditions and the role of moderate physical activity as a potential effect modifier. Methods: Well controlled crossover study design comparing serum BDNF levels pre- and 40 minutes post-exposure to traffic related air pollution. Thirty-one healthy non-smoking subjects were exposed for 2 hours to contrasting pollution levels while either cycling or resting. Each volunteer was to undergo all four conditions (high vs. low exposure; moderate physical activity vs. resting). On-site exposure monitoring included particulate matters, nitric oxides (NOx), and elemental carbon (EC). Results: Concentrations of ultrafine particles, EC, and NOx levels at the high exposure site on average 5, 7, and 10 times higher than the low exposure site, respectively. 28 volunteers completed all 4 exposure combinations (53,6% females; mean age 34,4 years). Mean BDNF comparisons showed a decrease from baseline in cycling subjects (-10.7% in low air pollution vs. -4.3% in high) compared with those in rest (0.7% in low air pollution vs. 6.9% in high). ANOVA comparing percent change from baselines between the four exposure conditions were non-significant (p=0.195).Mixed effect analysis showed a significant decrease from baseline in BDNF post physical activity when adjusted for covariates (Coef. -13.39, 95%CI -25.64 to -1.15, p=0.032). Single pollutant mixed effect models were non-significant for elemental carbon, ultrafine particles, nitric oxides, and particulate matter < 10 and 2.5 micrometers in diameter. Conclusions: In contrast to previous findings our study suggests that short term moderate physical activity in both, low and high levels of traffic related air pollution, decreases serum BDNF levels.

Abstract Number	**P-2-06-04**
Presenter	Klara Slezakova*, Simone Morais, Maria do Carmo Pereira
Exposure	metals
Health domains	no health domain
Type of research	health impact assessment

Carcinogenic health risks due to exposure to PM2.5-bound metals in indoor environments

Background: In the air toxic trace metals (including the carcinogenic ones) are mostly found in fine particles (PM2.5). During long–term exposures, these metals can cause severe health effects. Thus, their levels and risks are particularly relevant for indoors where people spend most of their time. Aims: The objective of this work was to assess levels and risks associated with exposure to PM2.5 carcinogenic metals (known, probable) in various indoor environments. Methods: PM2.5 was consequently collected at 5 different public (offices, cafeteria) and home environments. At each place, 24-h samples were collected during 2 weeks by low-flow samplers; occupant's activities were recorded.PM metals (Cr, Ni, As, Cd, and Pb) were determined by Proton Induced X–ray Emission. Carcinogenic health risks were assessed according to the methodology provided by USEPA Region III Risk–based Concentration Table for nine different age categories, ranging from children (1–3 years) to seniors (>65 years). Results: At homes total concentrations of five carcinogenic metals (Σcarc) were 6.25 and 9.64 ng/m3. At these environments, the USEPA health–based guideline level (10–6) was exceeded for 7 age categories, with the highest values observed for adults with 55–64 years (1.22×10-5) and seniors (1.46×10-5). In public environments, higher Σcarc were observed, with the highest levels found at cafeteria (144 ng/m3), possibly due to the permitted smoking. Corresponding health risks ranged from 2.26×10-6 (children 1–3 years) to 1.47×10-4 (seniors) thus largely exceeding (up to 147 times) USEPA guidelines level. Conclusions: In all studied indoor environments, long–term exposure to metals at the observed levels will increase carcinogenic risks. The risks were significantly higher in ambiences with tobacco smoke. Acknowledgements: K. Slezakova is grateful to FCT for her fellowship SFRH/BPD/65722/2009.

Abstract Number	**P-2-06-05**
Presenter	Chandresh Ladva*, Justin Chen, Brent Johnson, Jeremy Sarnat
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Characterizing noise and particulate matter in the vehicle microenvironment

Background: Health effects research of air pollution has little clarity in the relationship between particles and noise exposures. Sources of particle pollution tend to also produce high levels of noise pollution. Disentangling the effects of chemical and non-chemical exposures may be difficult; however, targeted intensive sampling of both in relevant microenvironments provides insight to effect modification or confounding in health effect assessments. Aim: Describe the relationship of noise as a predictor of particle pollution in the vehicular microenvironment through intensive sampling. Methods: Two scenarios, where air and noise pollutants were measured for ~2 hours, were examined six times each: 1) a stationary vehicle near a highway and 2) a mobile vehicle on the highway. In both scenarios, windows were alternated from opened to closed at 15 minute intervals. PM2.5 mass, ultrafine particles, and particles bound with polycyclic aromatic hydrocarbons (PAHs) were measured. Audio was measured in decibels. Linear mixed effect regression models were developed for each pollutant parameter-noise pair, and were grouped by sampling session. Results: In-cabin PM2.5 mass concentrations in our experiments were driven primarily by mobility. There was high heterogeneity in the sampling session effects, but the estimate of the average effect of mobility was still significant, 1.03 (0.70, 1.36)95%. No association was found with noise. Our study measured ultrafine particles in two different instruments with varying sensitivity to particle size. The prior two minutes of ultrafine concentrations were significant predictors of current minute concentrations (2.96-9.98, t = 1.73-4.98). Notably, noise was positively associated with ultrafine particle concentrations as measured by a condensation particle counter under all conditions of the sampling scenarios. Conclusions: Noise was found to be predictive for certain pollutant parameters, particularly ultrafine particle measurements. Conditions of vehicle activity were important modifiers of observed concentrations.

Abstract Number	**P-2-06-06**
Presenter	Jun Wu, Christina Lombardi, Travis Meyers, Michelle Wilhelm, Myles Cockburn, Beate Ritz*
Exposure	ambient air pollution
Health domains	cancer
Type of research	case-control study

Childhood cancer and traffic-related air pollution exposure in pregnancy and early life

Background: The literature on traffic-related air pollution and childhood cancers presents a mixture of findings, but to date few studies have used a sophisticated emissions-based model to assess pollution exposures in pregnancy and early childhood. Aims: The purpose of this study was to estimate risk of a number of different childhood cancers from traffic-related air pollution exposure in pregnancy and early childhood (<1 year of age). Methods: The present study included children younger than age 6 identified in the California cancer registry (born 1998-2007) who could be linked to a California birth certificate (N=3590). Controls were selected at random from California birthrolls (N=80,224). CAlifornia LINE Source Dispersion Modeling, version 4 (CALINE4) was used to generate estimates of local traffic exposures at the child's residence at birth during each trimester of pregnancy and in the first year of life. To confirm our results, we additionally examined associations with particulate matter (PM2.5) pollution, as measured by community-based air pollution monitors, and a simple measure of traffic density, for the purpose of comparing our findings to previous studies. Results: Using unconditional logistic regression, a per interquartile range increase in exposure to traffic-related pollution from CALINE4 was associated with increases in acute lymphoblastic leukemia [ALL; 1st trimester OR=1.05, 95% confidence interval (CI): 1.00, 1.09), retinoblastoma (1st trimester OR=1.11, 95% CI 1.02, 1.21), particularly bilateral retinoblastoma (OR=1.15, 95% CI 1.01, 1.32), and germ cell tumors (OR=1.15, 95% CI 1.04, 1.29). CALINE4 estimates were highly correlated across trimesters and the 1st year of life, making it difficult to discern the most important period for exposure. Similar patterns were observed in PM2.5 analyses for both ALL and retinoblastoma. Conclusions: Our findings support a relation between early exposure to traffic pollution and several childhood cancers.

Abstract Number	**P-2-06-08**
Presenter	Stefanie Sarnat*, Andrea Winquist, Marissa Maier, Philip K. Hopke, James Mulholland, Jeremy Sarnat, Paige Tolbert, Armistead Russell
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Comparison of source apportionment methods in a time-series investigation of source-resolved particle mixtures and cardiorespiratory emergency department visits

Background: Substantial evidence supports an association between particulate matter (PM) and cardiorespiratory illness, but less is known regarding specific PM sources that contribute to this association. Aims: We applied source apportionment (SA) outputs in a time-series investigation of emergency department (ED) visits in St. Louis, MO-IL to more fully examine the role of PM sources on health. Our objective was to assess the robustness of associations among different SA methods and to evaluate any between-method discordance. Methods: Daily speciated PM2.5 data were obtained from the St. Louis-Midwest Supersite for a 2-year period. Daily source contributions were estimated using positive matrix factorization, chemical mass balance, and ensemble models. We selected a subset of PM2.5 species as source tracers. Individual-level ED visit data were obtained from 36 acute-care hospitals in the study area. We used Poisson generalized linear models, controlling for long-term trends and meteorology, to examine associations between source-resolved PM2.5 and asthma/wheeze (ASW) and congestive heart failure (CHF) ED visits. Results: ASW visits were strongly associated with PM2.5, particularly in the warm season; associations were also observed for PM2.5-CHF in the cold season. Observed associations were largely comparable across SA methods for some sources, such as sulfate, nitrate, and soil. Epidemiologic results were less consistent across SA methods for other sources, such as mobile (gasoline and diesel) and secondary organic carbon sources, likely due to specific between-method differences in how PM is apportioned among these categories. Conclusions: Source-specific pollutant mixtures are associated with cardiorespiratory morbidity in St. Louis. However, associations for some sources differ by source apportionment method. Discordant results are being evaluated and the generalizability of our results to other cities (Atlanta and Dallas) is being examined.

Abstract Number	**P-2-06-09**
Presenter	Yoon-Hee Kang*, Yoo-Keun Kim, In-Bo Oh, Jin-Hee Bang, Jae-Eun Kang, Mi-Kyoung Hwang
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Estimating the contribution of traffic-related pollutants to urban air quality for applying a hybrid modeling approach

Traffic-related pollutants such as NO, NO2, PM and O3 which is indirectly produced through photochemical reaction are widely known as a serious hazard for human health. In this study, we estimate the contribution of traffic-related pollutants to ambient concentrations using CMAQ model and examine the “double count” of the same traffic emissions for applying a hybrid modeling approach, which is to combine the regional-scale air quality model and local dispersion model for linking the model-predicted gridded concentrations with population exposure model. Busan, the target area in this study, is the second largest metropolis located on the southeastern tip of the Korean Peninsula with a population of around 3.6 million. The main emission sources in the city are on-road mobile sources (50.5%), followed by non-road mobile sources such as shipping around port areas (17.6%) and solvent utilization (17.4%). In this study, to evaluate the impact of the traffic-related pollutants on outdoor ambient concentrations were quantified by analyzing the difference between model-predicted concentrations derived from two sets of simulation scenarios : (1) the WRF-SMOKE-CMAQ simulation for a 1 month (May, 2011) with (i.e., BASE case) and (2) without the traffic emissions (i.e., CNTL case). To evaluate the model validation for the BASE case, a statistical comparison was made between the observed and simulated values of both meteorological variables (air temperature, wind speed and direction) and air pollutants (O3 and NO2) at several monitoring sites. Overall, the simulated values show good correlation with the observations and indicate that O3-NO2 dynamics are generally well captured by the CMAQ (MBE of -7.4 ppb and 3.4 ppb for NO2 and O3, respectively). The differences between two simulations (BASE case minus CNTL case) are the range from -4 ppb to 60 ppb for NO2 and -44 ppb to 17 ppb for O3. This result reveals that traffic-related pollutants contribute negatively to O3 concentrations due to NOx increase under the NOx-saturated environment.

Abstract Number	**P-2-06-10**
Presenter	Tomohide Iwata*, Satoshi Nakai
Exposure	ambient air pollution
Health domains	policy
Type of research	exposure modeling

Estimation of intake fractions for benzene from motor vehicles by prefecture in Japan

Intake Fraction (iF) for motor vehicle exhausts by city or county, or even through whole county has hardly been estimated in Japan. We estimated iFs of nonreactive pollutants of motor vehicle exhausts by prefecture in Japan. In this study, benzene was selected as the subject pollutant, because it is one of the hazardous pollutants included in vehicle emissions and it is easy to collect emission data for benzene. We estimated ambient air concentrations of all over Japanese grids (5 km square) using ADMER (one of atmospheric dispersion model called Atmospheric Dispersion Model for Exposure and Risk Assessment developed by AIST, Japan) with 2005 meteorological data and 2005 emission data of each prefecture based on PRTR, in order to calculate iF attributed to the emission from each prefecture. Average iF value for benzene was 18.9×10-6 ranging from 2.2×19-6 (Akita prefecture) to 130×10-6 (Tokyo Metropolitan). These results suggest that benzene unit emission from Tokyo has potentially ~60 times higher health impact than the unit emission from Akita. This study showed that iFs of benzene for motor vehicle exhausts from each prefecture can be calculated in Japan using similar way to studies conducted at US and Europe, because PRTR emission data and dispersion model are available. However, it is still necessary to consider the selection of subject pollutants and size of source areas or segments and also the uncertainty of estimation methods and iF values, to apply iF concept to Japanese policies.

Abstract Number	**P-2-06-11**
Presenter	Jill Schulte*, Julie Fox, Sheryl Magzamen, Assaf Oron, Nancy Beaudet, Christopher Simpson, Michael Paulsen, Joel Kaufman
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

High-Density Air Sampling of Traffic Pollutants, Including 1-Nitropyrene, to Inform Fine-Scale Spatial Models of Diesel Exhaust

Background: Residents of two Seattle neighborhoods identified diesel exhaust as a primary health concern based on an abundance of neighboring sources, including commercial traffic routes, rail corridors and bus lines. Aims: To characterize the gradient of diesel exhaust at a fine scale within these neighborhoods using air sampling for four markers of varying specificity to diesel exhaust: 1-nitropyrene (1-NP), light-absorbing carbon (LAC), fine particulate matter (PM2.5) and oxides of nitrogen (NOx). Methods: The markers of diesel exhaust were monitored in a high-density, neighborhood-level air sampling campaign in order to compare their suitability as dependent variables in spatial modeling using land-use regression and deterministic modeling. Two-week average concentrations of 1-NP, LAC, PM2.5 and NOx were collected at 26 sites in summer and winter. Data were log-transformed and analyzed for correlation with distance to road, traffic counts, truck routes and other spatial covariates commonly used in predictive modeling of pollutants. Results: Of the four pollutants measured, 1-NP showed the highest relative variability (CV=0.72). Oxides of nitrogen showed the highest correlation with inverse distance to arterial road ($r=0.67$, $p<0.001$), though 1-NP was better correlated with inverse distance to arterial road weighted by traffic counts ($r=0.52$, $p<0.001$). Correlations with inverse distance to truck route were comparable among 1-NP ($r=0.76$, $p<0.001$), NOx ($r=0.75$, $p<0.001$) and LAC ($r=0.74$, $p<0.001$).Conclusions: As a unique marker of diesel exhaust with high relative variability and strong correlation with truck routes, 1-NP represents a promising proxy for diesel exhaust in spatial modeling. Light-absorbing carbon and NOx also appeared to be proxies for truck routes and would be suitable for spatial modeling of diesel exhaust. These results will be incorporated into hybrid land-use regression/dispersion models of diesel exhaust markers across the neighborhoods.

Abstract Number	**P-2-06-12**
Presenter	Michal Korek*, Tom Bellander, Ulf de Faire, Laura Fratiglioni, Claes-Göran Östenson, Nancy Pedersen, Göran Pershagen, Johanna Penell
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term exposure to traffic-related air pollution and cardiac events in four cohorts from Stockholm

Long-term exposure to traffic-related air pollution and cardiac events in four cohorts from Stockholm Background. Effects of long-term exposure to air pollution on cardiovascular outcomes have been studied extensively, but there are few prospective studies with individually assessed exposure to air pollution in relation to development of non-fatal and fatal cardiac events (CE). Furthermore, the role of timing of exposure has not been adequately investigated. Aim. To assess the risk of CE in relation to long-term exposure to air pollution, with particular focus on the influence by timing of exposure. Methods. Four cohorts enrolled 1992-2004 in Stockholm County were followed until 2009. Individual exposure to NOX and PM10 from local traffic was assessed with dispersion models and applied to the residential addresses during follow-up. Information on life style and other environmental exposures were obtained from questionnaires and clinical tests. Information on CE morbidity and mortality was retrieved from national registries. Cox regression analyses were performed on each cohort and combined using a meta-analysis approach. Adjustment was made for individual and contextual confounders. Results. The analyses included 19939 participants contributing a total of 744 CEs, including 146 fatal, until end of follow-up. In the combined analysis there was a hazard ratio of 1.09 (95% CI: 0.81-1.38) for CE associated with an average of 7.1 µg/m3 difference in PM10 exposure (5th to 95th percentile). The corresponding hazard ratio for nonfatal CE was 1.16 (95% CI: 0.84-1.48). In general, the results for NOX were similar to those for PM10, and the two exposures were highly correlated. No heterogeneity was apparent in risk estimates between different cohorts and sensitivity analyses did not reveal clear differences in relation to age and sex. Conclusions. We observed consistent non-significant associations between PM10 or NOX exposure and the risk of nonfatal cardiac events. However, the statistical power was limited to detect small excess risks.

Abstract Number	**P-2-06-13**
Presenter	Otto Hänninen*, Riikka Sorjamaa, Pasi Lipponen, Leena Kangas, Ari Karppinen, Tarja Yli-Tuomi
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Particle size dependence of respiratory tract uptake in a population cohort

Background. Sources and exposure levels of fine particles (PM2.5) are well known to vary over different microenvironments. Less investigated is the impact of particle size distribution on the respiratory tract uptake. However, the particle size, ranging from few nanometers to many micrometers, over more than three orders of magnitude, significantly affects the infiltration of ambient particles indoors and the uptake of the particles in the respiratory tract. Aim. The aim of the work is to use realistic spatial and particle size distributions in Helsinki to estimate the contribution of various sources and particle sizes to the human uptakes by respiratory tract regions. Methods. The current work uses the FINRISK-cohort with 5700 subjects in the Helsinki metropolitan area to estimate the exposure levels, infiltration and respiratory tract uptake of the particles. Particle concentrations were estimated for 2010 using CAR-FMI dispersion model. Emission source information was used to estimate lognormal source specific particle size distributions for the tailpipe, coarse and regional background concentrations. Size distributions observed at the Hyytiälä background station were used for the latter; the two other distributions were based on literature and thus contain larger uncertainties. Previously developed and evaluated model was used to estimate the changes in the particle size distributions by infiltration. ICRP 1994 model was then used to estimate the respiratory tract uptakes. Results. Particle mass uptake was dominated by accumulation mode particles in the alveolar region, followed by same particle size range in the bronchiole and then coarse (Dp 1-2.5 µm) particles in the alveolar region. Conclusions. When looking at particle mass, ultrafines do not dominate uptakes even in the alveolar region. Accumulation mode particles have an order of magnitude higher contribution to alveolar uptakes when ignoring times spent in traffic.

Abstract Number	**P-2-06-14**
Presenter	Payam Dadvand*, Bart Ostro, Fulvio Amato, Francesc Figueras, María-Cruz Minguillón, David Martínez, Xavier Basagaña, Xavier Querol, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	case-control study

Particulate Air Pollution and Preeclampsia: A Source-based Analysis

Background: Particulate matter (PM) air pollution is a heterogeneous mixture of components with different sources and toxicities. A limited body of evidence suggests an association between PM and preeclampsia; however, there is no available report on the possible link between PM sources and preeclampsia. Aims: To investigate the association between preeclampsia and maternal exposure to PM10 and PM2.5 mass and sources. Methods: Our analysis was based on a hospital cohort of pregnant women (N=3,182) residing in Barcelona, Spain, during 2003-2005. Positive matrix factorization source apportionment (PMF2) was used to identify sources of PM10 and PM2.5 samples obtained by an urban background monitor, resulting in detection of eight sources. We further combined traffic-related sources (brake dust, vehicle exhaust, and secondary nitrate/organics) to generate a traffic indicator. Logistic regression models were developed to estimate the association between preeclampsia and exposure to each PM source and mass separately during the entire pregnancy and trimester one, adjusted for relevant covariates. Results: For the exposure during the entire pregnancy, we found 44% and 80% increase in the risk of preeclampsia associated with one inter-quartile range increase in exposure to PM10 brake dust and traffic indicator respectively. These findings remained consistent after an alternative source apportionment method (Multilinear Engine (ME2)) was used that showed a 51% increase in the risk of preeclampsia in association with one interquartile range increase in PM10 road dust exposure during the entire pregnancy. The results for PM2.5 mass and sources and also exposure during trimester one were less conclusive. Conclusion: Risk of preeclampsia was associated with exposure to PM10 brake dust and traffic-related sources.

Abstract Number	**P-2-06-16**
Presenter	Taina Siponen*, Tarja Yli-Tuomi, Minna Aurela, Risto Hillamo, Maija-Riitta Hirvonen, Kati Huttunen, Juha Pekkanen, Raimo O Salonen, Pauliina Taimisto, Pekka Tiittanen, Timo Lanki
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	others

Sources of fine particulate air pollution and systemic inflammation

Background: Exposure to fine particles (PM2.5; diameter <2.5µm) is associated with cardiovascular health. Exposure to PM2.5 can accelerate systemic inflammation, which has been suggested to play an important role in the development of coronary heart diseases. The source of particulates affects their composition which may further modify cardiovascular effects. Aims: Our objective was to evaluate the association between source-specific PM2.5 and systemic inflammation among elderly subjects. Methods: We followed a panel of thirty-seven elderly subjects (>59 years of age) monthly for 6 months with clinical visits (minimum of three) including a blood-withdrawal in Kuopio, Finland, between November 2008 and May 2009. We determined blood levels of interferon-gamma (IFN), interleukin(IL)-1, -6, -8, -10 and -12, as well as tumor necrosis factor (TNF) to be used as indicators of systemic inflammation. Across the whole study period, we measured daily levels of air pollution at a central outdoor measurement site. We conducted source-apportionment for fine particles using positive matrix factorization 3.0.2.2. by the U.S. Environmental Protection Agency. We analyzed immediate and delayed effects of source-specific PM2.5 on log-transformed levels of inflammation markers using mixed models with random patient effects adjusting for time-trend, temperature, relative humidity and barometric pressure. Results: Number of successful clinical visits was 206. We found relatively few associations between air pollution and markers of systemic inflammation. IFN had suggestive positive association with PM2.5 from wood burning (10.7% (5-day average, 95%-confidence interval (CI): -1.0 to 23.9 %)) and with traffic (7.8 % (1-day lag, CI: -0.88 to 17.3 %)). There was suggestive association also with traffic and TNF (2.7 % (1-day lag, CI: -0.36 to 5.9 %)). Conclusions: We found only limited evidence on the effects of source-specific PM2.5 on systemic inflammation.

Abstract Number	**P-2-06-17**
Presenter	Nichole Baldwin*, Philip K. Hopke, Stuart Batterman, Suresh Raja, Thomas Robins
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Spatial-Temporal Variation of Pollutants in the Near-Road Environment

Background: Traffic-related air pollutants, such as black carbon (BC), fine particulate matter (PM2.5), and nitrogen dioxide (NO2) can exacerbate asthma and cause adverse health impacts. In many cities, high volumes of automobile and truck traffic pass through highly populated areas, potentially exposing nearby residents. Diesel engine exhaust is a special concern due to high emissions of PM2.5 and ultrafine particles (UFP). Aims: This study aims to depict the evolution of traffic-related pollutants in the near-road environment, and specifically to evaluate near road gradients of pollutant concentrations in Detroit, Michigan. It informs an epidemiological study examining whether children with asthma living closer to major roads, particularly those with high diesel traffic, experience greater health impacts than those living farther away. Methods: Air quality measurements, including BC, ultrafine particles (UFP), PM2.5, PM10, SO2, and NOx, were collected at 90 sites along 9 transects crossing highways at distances from 50 to 500 m from the road. Sampling was conducted during morning and afternoon rush hour periods on 7 consecutive days in 2 seasons using a mobile laboratory. Concentration trends associated with time of day, day of week, distance from highway, wind speed and direction, and season were evaluated. Results: Across all transects and study days, concentrations decreased by 4% (SO2) to 50% (NO) with distance from the road, while UFP diameters increased from 49 to 55 nm with distance. On average, pollutant levels were greatest during the morning rush hour period with calm and stable conditions, and elevated downwind for distances between 150 and 500m from the road. Trends were most clearly discerned for NO and BC, pollutants with lower background levels. Conclusions: The results show modest near-road gradients from traffic-related air pollutants, strong effects of meteorology, and an increase in accumulation mode particles with distance from highways. These trends will be used to help estimate exposures for the epidemiological study.

Abstract Number	**P-2-06-18**
Presenter	Kevin Lane*, Christina Fuller, Jonathan Levy, Madeleine Kangsen Scammell, Allison P Patton, John L Durant, Wig Zamore, Mkaya Mwamburi, Doug Brugge
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Structural Equation Modeling in a Near-Highway Exposure Study: Ultrafine Particles and Association with Cardiovascular Disease Risk

Background: Structural equation modeling (SEM) is a statistical method that has not been used widely in epidemiological studies of ambient air pollution. Aims: Assess the association between individually-calculated exposure to UFP (<100 nm, estimated as particle number concentration or PNC) and cardiovascular disease risk. Methods: Air pollution data based on 55 days of mobile monitoring was used to build a regression model for assigning residential ambient hourly PNC for participants of the Community Assessment of Freeway Exposure and Health (CAFEH) study (N=140, a subset of CAFEH). Participants completed questionnaires on residential and occupational exposure, income, education, smoking, diet, physical activity and stress. Blood samples were analyzed for C-reactive protein (CRP), interleukin-6 (IL-6), tumor necrosis factor-α receptor II (TNFα); fibrinogen. Ankle brachial pressure index (ABI) as well as systolic, diastolic and pulse pressures were also measured. SEM was conducted using Proc Calis in SAS to determine path loadings, p-values between latent variables, and the individual variables contributing to the latent variables. Results: CRP, IL-6 and TNFα were not normally distributed and had population median values of 1.62mg/L for CRP; 1.61pg/mL for IL-6; and 2256pg/mL for TNFα. Fibrinogen was normally distributed with a mean of 475mg/dL. Initial SEM model development for the dependent latent variable construct cardiovascular disease risk produced the largest standardized estimates with the indicator variables CRP, TNFα, BMI, hypertension, and IL-6. PNC and the independent latent variable construct other combustion exposures displayed a positive association with cardiovascular disease risk, while and socio-economic status displayed a negative association. Conclusion: Initial analysis indicates that our model may have one endogenous latent variable, cardiovascular disease risk, and two or more exogenous latent variables related to air pollution and lifestyle.

Abstract Number	**P-2-06-19**
Presenter	Emmanuel S. Baja*, Joel D. Schwartz, Brent A. Coull, Gregory A. Wellenius, Pantel S. Vokonas, Helen H. Suh
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Structural equation modeling of parasympathetic and sympathetic response to traffic air pollution in a repeated measures study

Background: Traffic-related air pollution has been associated to a range of adverse health impacts, including decreased heart rate variability (HRV). Aims: In a Bayesian framework, we examined the effect of traffic pollution on HRV using structural equation models (SEMs) and looked at effect modification by participant characteristics. Methods: We studied measurements of 5 HRV markers [high frequency(HF), low frequency(LF), 5-min standard deviation of normal-to-normal intervals(SDNN), square root of the mean squared difference of successive normal-to-normal intervals(rMSSD), and LF/HF ratio(LF/HF)] for 700 elderly men from the Normative Aging Study. Using SEMs, we fit a latent variable for traffic pollution that is reflected by levels of black carbon (BC), CO, NO, and NO2 to estimate its effect on latent variables for parasympathetic tone that included HF, SDNN and rMSSD, and the sympathetic tone marker, LF/HF. Exposure periods were assessed using 4-, 24-, 48-, 72-hour moving average pre-visit. We compared our main effect findings using SEMs with those obtained using linear mixed models (LMMs). Results: Traffic pollution was not associated with mean parasympathetic tone and LF/HF for all examined moving averages. In LMMs, however, BC was related to increased LF/HF, an inter quartile range(IQR) increase in BC was associated with a 6.5% (95% posterior interval(PI): -0.7%, 14.2%) increase in mean LF/HF 24-hours later. The most significant association observed for the 4-hour moving average (10.1%; 95%PI: 3.0%, 17.6%). Association between parasympathetic tone and traffic was stronger in diabetic participants, an IQR increase in traffic pollution 48-hr pre-visit was associated with a -44.3% (95%PI: -67.7%, -4.2%) change in mean parasympathetic tone among diabetic participants, while for the non-diabetic [7.7% (95%PI: -18.0%, 41.4%)]. Conclusions: BC adversely impacts LF/HF in the elderly. Traffic pollution may decrease parasympathetic tone among diabetic elderly. Structural equation modeling may be an alternative approach in air pollution epidemiological studies.

Abstract Number	**P-2-06-20**
Presenter	Anna Schembari*, Kees de Hoogh, Payam Dadvand, Marie Pedersen, David Martínez, Gerard Hoek, Emily Petherick, John Wright, Mark J Nieuwenhuijsen
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Traffic-related air pollution and adverse pregnancy outcomes in a multi-ethnic society. Results from the Born in Bradford cohort study.

Background:Traffic related air pollution has been linked to several adverse pregnancy outcomes. In Bradford UK there are concerns about adverse birth outcomes and higher than average rates of childhood morbidity and mortality. Aim: We investigated the impact of exposure to traffic-related air pollution (NOx, NO2, PM10, PM2.5-10, PM2.5, and PM2.5 absorbance) on pregnancy outcomes (birth weight, head circumference, and gestational age) with particular emphasis on the possible effect modification by the ethnicity. Method:Mother-child pair data from the Born in Bradford (BiB) cohort study were recruited between March 2007 and November 2010. We used a spatiotemporal exposure assessment framework based on land use regression models that were developed in the ESCAPE project to predict pollutant levels at the geocoded address of each study participant's residence during each week of her pregnancy. Linear and logistic regression models were used to quantify the associations between air pollution exposure and outcomes. Stratification analyses were conducted by ethnic group. Results: In the analyses we included 10848 mothers - child pairs, with main ethnic groups being White British origin (40%), and of Pakistani origin (45%). We found increased risk of preterm birth, adjusted OR 1.23, (95% CI: 1.02-1.48), reduced birth weight of 35 gr (95% CI: -53gr to -18gr) and reduced head circumference of 2 mm (95% CI: -3mm to -1.5mm) for each 5 µg/m3 increase in the third trimester exposure to PM2.5. The magnitude of these effects differed by ethnicity: mothers of Pakistani origin tended to have higher risk of preterm birth, no risk for lower birth weight and smaller reduction in the head circumference compared to mothers of White British origin. Conclusions: We found an association between air pollution and adverse birth outcomes, with differential effects between those of White British population origin and those of Pakistani origin.

Abstract Number	**P-2-06-21**
Presenter	Matti Jantunen*, Eduardo Oliveira Fernandes, Marie-Eve Héroux
Exposure	ambient air pollution
Health domains	policy
Type of research	review

WHO REVIHAAP Question C-10: contribution of ambient air pollution to total exposure considering exposures from indoor, commuting and work environments

Review of evidence on health aspects of air pollution – REVIHAAP addresses 24 questions relevant for the European policies on air pollution. A group of scientists reviewed and discussed the recent evidence on health effects of air pollution, formulated science-based answers to the given questions and supported them with extensive rationales. The answer to REVIHAAP Question C-10 is: · Tobacco smoke, where permitted indoors, dominates the exposure to PM2.5, BC, UFP, CO, benzene, BaP and naphthalene, and contributes to NO2 exposure. The further answers refer to tobacco smoke free conditions. · Air pollution exposures of indoor and occupational origin and commuting vary between the individuals more than exposure to air pollution of ambient origin, and depend strongly on the microenvironments and behaviour of the individual. · Specifically, commuting can increase exposures to particulate matter, NO2, CO and benzene, and is a major contributor to the exposure to UFP, BC and some metals, most importantly Fe, Ni and Cu in underground rail commuting. · Population exposures to NO2, PM2.5, BC, O3, CO and SO2 (with more limited evidence about BaP, As, Cd, Ni and Pb) originate dominantly from ambient air. · Ambient air, indoor sources and commuting are all important for population exposures to NO2 (where gas appliances are frequent), benzene and naphthalene. · The high end individual exposures to PM10-2.5 and naphthalene originate from indoor sources and commuting. · In suboptimal conditions solid fuel fired indoor fireplaces and stoves dominate the high end PM2.5, BC, UFP, CO, benzene and BaP exposures of the affected individuals. Details of the rationale will be presented [in the poster]. Acknowledgement: The REVIHAAP project was funded by the WHO Regional Office for Europe and the European Union. Its conclusions reflect the collective judgment of the experts involved in the review, and not necessarily those of WHO or the EU.

Abstract Number	**P-2-08-01**
Presenter	Stefano Zauli Sajani*, Isabella Ricciardelli, Dimitri Bacco, Silvia Ferrari, Claudio Maccone, Stefano Marchesi, Fabiana Scotto, Arianna Trentini, Paolo Lauriola, Vanes Poluzzi
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

A comparison of size distribution and chemical composition of fine particles in residential and traffic sites

Background. Exposure to air pollution from traffic is a major public health concern. Aims. The objective of the study is the improvement of the characterization of indoor and outdoor population exposure to traffic pollutants. Methods. The measurement campaigns were carried out in the urban area of Bologna, a highly polluted city in northern Italy. Both indoor and outdoor monitoring was simultaneously carried out at a residential setting as well as at a heavy traffic site. Indoor environments were uninhabited, very similar in terms of volumes and building materials, and air exchange rates were maintained at the fixed value of 0.5 h-1, a typical level for residential environments. The main goal was to assess the differences of population exposure to particles in relation to traffic without considering the specific indoor characteristics and personal behaviours. Both sites were monitored during three15-day periods, suitably distributed to cover the different seasons. We collected data on mass and chemical composition (ions, organic and elemental carbon, metals) of PM2.5. Two FMPSs (TSI) provided size distribution of particles in the 5.6-560 nm interval with 1-min time resolution. Two switching units, one for each site, alternatively activated indoor and outdoor inflow with a switch time of 10 min. Results. While we found very similar PM2.5 mass concentrations in the two monitoring sites, chemical composition and ultra-fine particles (UFP) showed large differences. UFP outdoor concentrations in the traffic site were almost twice as much as the residential site. Indoor UFP concentrations were much lower than outdoor with a ratio between the two sites similar to outdoor concentration ratio. Indoor/outdoor ratio showed an inverse relation with outdoor concentrations. Size distribution showed a strong multi-modality with relevant differences between the two sites. Conclusions. We found marked differences of UFP between the traffic and the residential site in both indoor and outdoor levels. Very little differences were found for PM2.5 mass.

Abstract Number	**P-2-08-02**
Presenter	Zhengjian Du*, Jinhan Mo, Yinping Zhang
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

A Mass Transfer Model to Predict the Performance of Tube-type Passive Samplers for Exposure Determination of Volatile Organic Compounds

In past decades, due to its cost-effectiveness and convenience, passive samplers have been frequently employed to investigate spatial and long-term temporal trends of volatile organic compounds (VOCs) at local, regional scales and to assess people's exposure to VOCs (Raw et al., 2004; Vardoulakis et al., 2011). Uptake rates (URs) of passive samplers have been verified to be the main source of the uncertainty of measurement (Plaisance et al., 2008; Martin et al., 2010; Walgraeve et al., 2011). Thus it is necessary to determinate the uptake behaviors of passive samplers and keep the URs stable for accurate exposure measurement. Some models have been developed to predict the URs of passive samplers. However, these models have been limited either by neglecting parts of the mass transfer processes of passive uptake or by considering only a small subset of VOCs, which are not sufficient for the design and sorbent selection of passive samplers for different VOCs (Palmes et al., 1973; Coutant et al., 1985; Tolnai et al., 2001). The objective of this study is to build a general model based on the mass transfer processes of tube-type passive samplers which are popular in environmental monitoring. By using the finite difference method, the model can be solved coupling with mass conservation equations applied at the boundaries. The model could be used to calculate the effective URs of tube-type passive samplers under various conditions and to select the proper sorbents which can be effective for different VOCs. The kinetic resistance within the sorbents results in two distinct uptake processes for passive sampling; diffusion coefficients D and partition coefficients K of VOCs between the sorbents and the air phase are the main influencing factors. Temperature dependence of URs may be described by the model once the temperature dependence of D and K is available.

Abstract Number	**P-2-08-03**
Presenter	Dorina Gabriela Karottki*, Michal Spilak, Marie Frederiksen, Lars Bo Gunnarsen, Elvira V. Brauner, Zorana J. Andersen, Torben Sigsgaard, Peter Møller, Steffen Loft, Barbara Kolarik
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

An indoor air filtration study in homes of elderly: cardiovascular and respiratory effects of exposure to particulate matter

Background Particulate air pollution increases mortality and morbidity related to respiratory and cardiovascular diseases, especially for susceptible individuals such as the elderly, possibly through oxidative stress, systemic inflammation and endothelial dysfunction. In a previous study, 48 hours air filtration in the homes of 41 healthy subjects (60 to 75 years) reduced PM2.5 concentrations from 12.6 to 4.7µg/m3 and improved the microvascular function by 8%(Brauner et al., 2008). Aims In this study we examined potential beneficial effects of two weeks air filtration in the homes of an elderly population, including people taking vasoactive drugs. Methods Re-circulating custom built particle filtration units with or without the inclusion of a high-efficiency particle air (HEPA) filters were used in a randomized, double-blind, crossover intervention study in 27 homes with 48 nonsmoking subjects (51 to 81 years), exposed to consecutive 2-week periods of either particle-filtered or non-filtered air in their living and bedrooms. At the beginning of the study (baseline) and at day 2, 7 and 14 after each exposure scenario we measured blood pressure, microvascular- and lung function and collected saliva, urine and blood samples to quantify different hematological parameters and markers of inflammation, monocyte surface markers and oxidative stress. Results The inclusion of particle air filters changed the concentration of PM2.5 from approximately 8 to 4 µg/m3 and the ultrafine particle number count from 7669 to 5352 particles/cm3. No statistically significant effects of filtration were observed on microvascular- and lung function or the biomarkers we measured among all subjects or in the subgroups taking (n=15) or not taking vasoactive drugs (n=33). Conclusion With the exposure gradient achieved no beneficial effect of air filtration for two weeks could be documented in this elderly population, irrespective of use of vasoactive drugs.

Abstract Number	**P-2-08-04**
Presenter	L. Drew Hill*, B. Temuujin, Yumchindorj D., Rufus Edwards, G. Suvdaa, G. Jargalsaikhan, Nicholas Lam, Chimedsuren O., Damka O., Ajay Pillarisetti
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

AN INITIAL ASSESSMENT OF WINTER TRENDS IN INDOOR PARTICULATE POLLUTION (PM2.5) IN THE GER REGION OF ULAANBAATAR, MONGOLIA

Background: Ulaanbaatar (UB) is home to 40% of Mongolia's 2.74 million residents and growing. A population boom combined with long heating seasons (~ 8 mo.), frequent temperature inversions, and a valley topography has led to dangerously high levels of PM2.5. For example, average wintertime PM2.5 concentrations in 2009-2010 were measured at 250 µg/m3. It is expected that such levels likely result in substantial increases in mortality and morbidity. It is also expected that indoor exposures contribute heavily to total exposure of PM2.5, as approximately half of UB's residents live in yurt-like gers and rely on a mix of dirty solid fuels (coal and wood) in poorly-combusting stoves to meet their heating needs. Aims: We undertook a pilot study of indoor and outdoor PM2.5 concentrations at ger homes using one of three stove types: a traditional coal stove, an "improved" coal stove (jointly subsidized by the US Millennium Challenge Corp. and the Mongolian government), and a locally piloted stove fueled by a coal-to-gas fuel called dimethyl ether (DME). In addition to validating PM2.5 monitoring methodologies for harsh winter environments (-40C), we explored the relationships between indoor and outdoor PM2.5 concentrations in the ger region of UB. Methods: Continuous PM2.5 and stove-use data were used to relate indoor and outdoor concentrations with household heating practices. At each of our sample gers, we placed one UC Berkeley Particle and Temperature Sensor (UCB-PATS) outside, one UCB-PATS inside the stove room (used for sleeping, eating, cooking, and general socializing), and fit all appliances that may emit considerable PM2.5 with UC Berkeley Stove Use Monitoring Sensors (SUMS). UCB-PATS were calibrated in field with filter colocations. Results & Conclusions: Filter samples collected during instrument calibration demonstrate 24-hr average PM2.5 concentrations as high as 610 µg/m3 (outdoor) and 275 µg/m3 (indoor), and 12-hr averages as high as 490 µg/m3 (indoor). Results by stove type, temperature, and other parameters will be presented.

Abstract Number	**P-2-08-05**
Presenter	Christine Daeumling, Maria Scutaru*
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Challenges in Harmonizing the Evaluation of Building Products Emissions in Europe

A prerequisite for healthy air quality indoors are low emitting materials. In 2014, there will be three mandatory systems in place to evaluate the emission properties of building products in Europe: In Germany since 2006 the AgBB-Scheme defines pass-fail criteria with in its core a long list of 176 assessable substances; in France since 2012 a labelling decree defines emission classes for 10 indoor pollutants and in Belgium, beginning in 2014, a Royal decree demands building products to comply with a set of criteria focusing on evaluation by means of a long list of assessed substances, similar to the German procedure. Besides the mandatory systems there are a number of voluntary, health related quality labels in European countries offering help for the consumer to choose a ‘safe’ product in regard to controlled emissions. The major European labels had joined an initiative to harmonize the different labelling criteria; the result was a proposal published in 2010 in ECA Report 27. The core of a harmonized evaluation was seen in a harmonized list of assessed substances with so called LCI values (Lowest Concentration of Interest) for an appropriate number of substances encountered in emission tests. Consequently, a working group coordinated by the Joint Research Center of the European Commission has started to develop a new science based harmonized procedure how to derive health related thresholds for the sum of substances regulated in France and Germany. A pragmatic approach has been chosen for substances whose LCIs did not differ substantially in France and Germany. After a two year effort of experts from nine European countries an Interim EU-LCI list was presented to the Commission and industry stakeholders in December 2012. These results will be published in 2013 but the fate of this activity remains open. The perspectives and consequences for the national systems will be drafted as example for the German situation. The need and key benefits of a complete EU-LCI list will be discussed for regulators, manufacturers and consumers.

Abstract Number	**P-2-08-06**
Presenter	Karen Galea*, Alice Davis, David Todd, Carolyn McConagle, Laura MacCalman, John Cherrie, Chris Money, Alison Margary, Jan Urbanas, Arlean Rohde
Exposure	others
Health domains	other
Type of research	exposure measurement

Determination of the potential for dermal exposure from transfer of lubricants and fuels bu consumers

Consumer uses of fuels and lubricants are subject to the Registration, Evaluation, Authorisation & restriction of CHemicals (REACH) legislation. There are only limited data relating to dermal exposure for these products and it has been necessary for the industry to develop exposure assessments that are based on a series of conservative assumptions consistent with the REACH Technical Guidance. These assessments have concluded that there is no need for additional exposure controls beyond current practices. While this is reassuring it would be prudent to obtain further data to enable future assessments to be more robust. Our study aimed to characterize the magnitude of dermal exposure to the hands and forearms, and to assess the environmental and behavioural determinants of the exposures during four simulated simulation scenarios using a validated wipe sampling method and the products natural fluorescence under Ultra-Violet (UV) light. Ten volunteers completed a series of standardized exposure situations to represent adding lubricant to a car engine (two scenarios, one more difficult to reach than the other), lubricating a bicycle chain and filling a vehicle fuel tank with diesel. Each volunteer completed a total of eight exposure situations (two for each situation) giving a total of 80 completed trials (20 per scenario). Sample/data analysis and reporting will be completed by end March 2013 and we would welcome the opportunity to submit an updated abstract at this time. During our presentation we will provide an overview of the methodology employed, results of the volunteer tests and a discussion of the findings.

Abstract Number	**P-2-08-07**
Presenter	hyun ah Ji, In-Keun Shim*, Wooseok Lee, Sooran Won
Exposure	others
Health domains	no health domain
Type of research	time series study

Distribution of mass concentration and chemical analysis of particulate matters (PM2.5, PM10) in indoor parking lots in Korea

Number of vehicles in Korea has been rapidly increased from 14,580,000 to 18,662,000 in recent 10 years. This made the number of indoor parking lots to be expanded and therefore the facility users are more easily exposed to indoor air pollutants especially fine particulate materials. Many previous studies reported that the fine airborne particulate matters especially in the case of the diameter less 2.5μm than could be accumulated on the lung and bronchial tubes and lead to the lung cancer, asthma and so on when they are exposed for a long period of time. In this study, we collected airborne particulate matters (PM2.5, PM10) for 24 hours with mini volume air sampler in indoor/outdoor air of targeted 10 facilities from May 2011 to October 2012. In addition to survey the mass concentration of particulate matters, the 8 kinds of ions (Cl-, NO3-, SO42-, Na+, NH4+, K+, Mg2+, Ca2+) and 2 kinds of carbons (Organic Carbon, Elemental Carbon) in particulate matters are analyzed by Ion chromatography and ICP/MS to find out indoor pollutant sources. As a result of chemical analysis, NO3- and SO42- showed higher concentration than the other 6 kind of ions due to the exhaust of vehicles in these indoor environments. The outdoor EC mean concentration of PM2.5 was 3.8 ± 1.0 μg/m3 and that of PM10 was 4.7 ± 1.5 μg/m3 respectively. On the other hand, the indoor EC average concentration of PM2.5 (3.8 ± 1.0 μg/m3) and PM10 (4.7 ± 1.5 μg/m3) was higher than that of outdoors. The reason the mean concentration of indoor particulate matters was about two times than that of outdoors is supposed to the generation and accumulation of EC by incomplete combustion of gasoline, diesel automobiles in indoor space. Beside, indoor parking lots had been remained high mass concentration due to frequent entry and exit of vehicles during operation time. And the highest mass concentration was recorded in the lunch time due to frequent uses of facilities.

Abstract Number	**P-2-08-08**
Presenter	Thiault Guenael*, Ghislaine Goupil, Claudine Delaunay, Eddie Faure, Loic Paillat, Laurence Durupt
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Dry cleaning tetrachlorethylene pollution impact on indoor air quality in Paris territory

The Central Laboratory of the Police headquarters (LCPP) is a public department which has the task among others of showing up harmful effects from exterior sources. These effects can be followed by some deteriorations of indoor air quality in close dwellings. The aim of this study is to investigate dry cleaning sources that could cause intoxications and to identify the pollution transfer mode in indoor air (air ventilation, ceiling, sewage network). The air is sampling by using sensor (passive sampling) during 7 days or by using pumps during 1 to 8 hours (active sampling) on charcoal trap and solvent desorption. The identification and quantity determination are realised by Gas Chromatography coupled to a Flame Ionization Detector (GC/FID) or to a Mass Spectrometer (GC/MS). The laboratory is accredited according to ISO 17025 for VOCs measurement on charcoal traps and the uncertainty is estimated to be around 20%. Some important levels of tetrachloroethylene were measured after more than 100 investigations in dwellings resulting from proximity complaints since 2010. The statistics results of these different studies will be discussed here. More than 80 % dwellings located above dry cleaners were polluted by tetrachloroethylene. Levels were clearly higher than the references values provided by the French high council of public health (0.25 mg/m3 for a guide value and 1.25 mg/m3 for a quick action to reduce air pollution). 50% of dwellings have tetrachlorethylene levels higher than 0.25 mg/m3. A maximum value of 120 mg/m3 have been measured in a bedroom just around a dry cleaner. Transfer modes of pollution were identified with simultaneous measures in dwelling, staircase and outdoor nearby home air inlet. The main transfer mode was carried out by ceiling or technical passage. Works of putting in conformity can be prescribed to dry cleaners. Results of studies realized before and after these works will be described. Measurements realized in dwellings above dry cleaners using substitute products of tetrachlorethylene will also been presented.

Abstract Number	**P-2-08-09**
Presenter	Philip K. Hopke*, Mehdi Amouei Torkmahalleh, David Schamberger, James Laing, Alan Rossner, Andrea Ferro
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Emission fluxes of different metals in aerosol emitted during frying-Effect of frying pan

The primary sources of indoor particles in homes are cooking and tobacco smoking. Cooking emissions result in human exposure to both PM2.5 and UFP. Among cooking activities, frying or stir-frying have been found to be responsible for the highest particle emissions. Prior studies have found that frying was the largest source of particle emissions when compared with other cooking methods. Cooking sources can cause relatively high pollutant exposures with likely adverse health effects. Understanding the health effects of indoor cooking sources and how to reduce them will require the knowledge of both the source emission rates and the composition of the pollutants. It has been found that deep-frying generated particles with the largest amount of organic pollutants, such as OC, PAHs, and organic ions, as well as metals. During deep-frying, Cu, Fe, and Zn were the three major metals emitted. These metals could be generated from the oil, the food itself, the gas stove, or the pan. Also, the particulate emissions contained some metals with high water solubility. Little is known about the chemical properties of particles emitted from cooking. A new study has been conducted to measure the emission fluxes of metals generated through heating of cooking oils in a pan. The experiments were conducted in an operating laboratory hood. Filter based mass measurements were performed to collect the generated particles from heating soybean oil with three different pans (cast iron, ceramic and stainless steel). The filters were analyzed using ICP/MS. The results of these experiments will be presented.

Abstract Number	**P-2-08-10**
Presenter	Jinhan Mo*, Zhengjian Du, Yinping Zhang
Exposure	household air pollution
Health domains	no health domain
Type of research	others

Evaluation of a new thermo-regenerative air cleaning device for reducing indoor exposure of multiple gas-phase contaminants

Background: There are many types of gas-phase contaminants indoors. Exposure to these compounds can cause some serious adverse health effects like allergy, cancer and leukemia etc. Adsorption technology is widely used to remove these pollutants for healthy indoor environment. However, the life span for indoor air pollutants is short, especially when the indoor concentrations of sub-ppbv level. Aims: This work aims to develop a new air cleaning device with thermo-regeneration for long term application. Methods: A thermo-regenerative air cleaning device is developed. Its removal performance for 8 kinds of indoor contaminants (acetaldehyde, ethanol, toluene, ethyl acetate etc.) is continuously validated in 30-round close-loop test and 6-round single-pass test. Each round spends 24 hours. After every round test, the device will be thermo-regenerative. The concentrations of contaminants were analyzed by GC-FID with the two-layer sorbent tubes (Tenax TA and Carbosieve III). The influence of moisture concentrations to the removal efficiency of pollutants is also detected. Results: Although the removal efficiency of pollutants is decreasing initially with the round times increasing, it keeps stable after 30-round test. The average removal efficiency of all pollutants is larger than 90% finally. Moisture is found to have great negative or passive impact to the adsorption effect, which seems linking to the hydrophilic or hydrophobic performance of pollutants. Conclusions: The results indicated that the developed air cleaning device can efficiently and continuously remove common indoor pollutants. It can be used to reduce the indoor exposure of multiple gas-phase contaminants simultaneously.

Abstract Number	**P-2-08-11**
Presenter	Norbert Weis*, Marina Wasmuth, Chris Vanessa Sumowski, Britta Neuweger, Marcus Bäumer, Michael Köhler
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Exposure of Nanoparticles in Indoor Air and on Interior Surfaces – A Study of Detection Techniques

Exposure of Nanoparticles in Indoor Air and on Interior Surfaces – A Study of Detection Techniques M. Wasmutha, C.V. Sumowskia, B. Neuwegera, M. Bäumerb, M. Köhlera, N. Weisa aBremer Umweltinstitut GmbH and bUniversität Bremen, 28359 Bremen, Germany The use of nanoparticles in everyday products is steadily increasing [1]. At the same time, little is known about the exposure of nanoparticles into the environment and especially into indoor air [2]. In addition, measurement techniques currently used for common indoor air pollutants are not applicable for nanoparticle detection. Therefore, in the present study, detection techniques were studied regarding their applicability to determine potential nanoparticle contaminations in indoor air and on interior surfaces. To study possible detection techniques, an exposure scenario was simulated within a standardized sample chamber. A commercially available, well characterized plant strenghtener containing silver nanoparticles was applied within the sample chamber and the recovery rates for the overall silver content were determined by wipe and material samples using atomic absorption spectroscopy. The applicability of contact samples and air sampling to detect potential contamination on nano scale was addressed by electron microscopy techniques. The results show a strong dependence of silver-content recovery-rates on the surface materials applied within the sample chamber. Nevertheless, in all test cases silver nanoparticles could be identified on contact and collected air samples. Overall, the applicability of the studied detection techniques for a qualitative assessment of nanoparticle contamination could be shown. For a better understanding of exposure scenarios for nanoparticles, further studies focusing on quantitative approaches and a broad diversity of applications will be crucial. [1] B. Nowak et al.; Environmental Pollution 150, 5 (2007) [2] M.E. Quadros et al.; Environmental Science and Technology 45, 10713 (2011)

Abstract Number	**P-2-08-12**
Presenter	Markey Johnson*, Gary Mallach, Ryan Kulka, Russell Dietz, Terry Sullivan, Mark Gibson, Lance Wallace, Halûk Ozkaynak, Ronald Williams, Amanda Wheeler, Keith Van Ryswyk
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Factors Influencing Indoor Air Quality in an Urban High-Rise Apartment Building

Background: Eighty percent of North Americans reside in cities and many urban dwellers live in high-rise apartments. However, few studies have examined pollutant concentrations in North American high-rise homes. The Ottawa Apartment Study examined factors influencing pollutant concentrations in an urban high-rise apartment building in downtown Ottawa, Ontario. Methods: We recruited apartments on lower, middle, and upper levels of the building. Neighboring units were included to assess vertical and horizontal infiltration. The study measured particulate matter (PM2.5), metals, and volatile organic compounds (VOCs), as well as air exchange. Continuous and integrated measurements were collected at approximately 30 sites including apartments (indoor and balconies), hallways, stairwells and the rooftop. Perfluorocarbon tracers were deployed to provide air exchange rates between indoor micro-environments as well as the outdoor air exchange rate. Building and occupant information were obtained through baseline and daily questionnaires. Results: Metal concentrations were typically higher on balconies and in hallways, while VOC concentrations were higher in apartments. PM2.5 concentrations did not vary significantly between micro-environments. There was some evidence to suggest that ambient concentrations of some metals and VOCs were higher at street level compared with upper level balconies. Outdoor PM2.5 from the balconies and central ventilation system were the major predictors of continuous PM2.5 concentrations in the apartments, with a smaller contribution explained by neighboring units. These results were consistent with the percent contribution based on air exchange measurements. Other factors influencing indoor concentrations (e.g., occupant activities and indoor sources) were similar to those for single family homes. Conclusions: Although many North Americans live in high-rise buildings, little information is available about their residential exposures. This study provides support for identifying strategies to reduce exposure in high-rise buildings.

Abstract Number	**P-2-08-13**
Presenter	Youngmin Cho*, Seung-Woo Hong, Duck Shin Park, Soon-Bark Kwon, Woo-Sung Jung
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	case-control study

Feasibility study on the adsorptive control of indoor CO2 inside car by using solid CO2 adsorbent

Low concentration of CO2 is known to be harmless to human, but high concentration of CO2 may cause several adverse effects in car. Ventilation is one of the easiest ways to reduce indoor CO2 concentration in car, but the ventilation is not always good in urban area. Since various air pollutants, like particulate matters, volatile organic compounds, and formaldehyde may come into the car during ventilation. When the car moves slower than 40 km/h, CO2 concentration in the car can be higher than 4,000 ppm in the absence of ventilation. In this study, another way to reduce CO2 concentration was proposed. CO2 adsorbent was introduced to remove the indoor CO2 in the car. A small CO2 adsorption system was prepared, and installed in a sedan car. The car was driven in urban area and highway, and CO2 concentration change in the car was monitored with and without the operation of this system. The effect of car speed, the number of passengers, the amount of loaded adsorbent, and the fan speed was investigated. It was found that indoor CO2 concentration could be lowered by more than 1,000 ppm by operation of this system when 3 passengers were onboard.

Abstract Number	**P-2-08-14**
Presenter	Nathalie Abrahams*, Diana Maria Caicedo-Borrero, Fabián Mendez
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Housing characteristics and practices that potentially contribute to air pollution in Cali, Colombia

Housing characteristics and practices that potentially contribute to air pollution in Cali, Colombia. Background In Cali, Colombia, a group of children living in one of the poorest sectors of the city is being followed to determine the effects of environmental pollution on their health. Indoor air levels evaluation resulted in high levels of particulate matter, in addition to the presence of heavy metals in the air. This second phase seeks for potential sources of air pollution inside the house, taking into account housing characteristics and practices of its inhabitants. Methods A survey was applied to determine housing characteristics and practices that may have influence on indoor air quality. The survey was administered to mothers of a cohort of children who have been followed from the first trimester of pregnancy. Observation was also done in the home to determine the presence of dust and building materials. Results The 54.23% of households had over 15 years of built. Regarding the characteristics of ventilation 85.71% of households had window in their halls-dinning room facing the road, 38.18% of rooms had this characteristic. The latter is related to the report of vehicle traffic on the street often (27.12%). The research for practices like using candles, incense and mosquito coils was very low and at such times the frequency was "occasionally". Use of insecticides in the home was very frequent reaching 56.73% of households, where presentations that were tipically used was powder, liquid or aerosol. Discussion Indoor air quality has been poorly studied in Latin America, particularly in Colombia these studies are almost nonexistent. Given the differences in customs and housing characteristics with the developed countries, it is necessary to make an inventory of these conditions that may affect exposure to air pollution in vulnerable populations, with the aim of perform the actions necessary and feasible to improve the conditions of life of these populations.

Abstract Number	**P-2-08-15**
Presenter	Ruey-Yu Chen*, Kun-Yi Chang, Ching-Ying Yeh, Ling-Chu Chien
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Indoor Air Quality and Related Factors in University Oil Painting Classrooms

Background: There are thousands of students and teachers involving in university oil painting classes in Taiwan, but few studies have been conducted to examine the air quality of oil painting classrooms. Aims: To investigate the air quality and levels of turpentine oil in university oil painting classrooms, and hope the results will help improving their teaching environment. Methods: Three oil painting classrooms in three universities were selected as study subjects. A real- time air monitor was used to record temperature, humility, and conc. of CO2, CO, O3 and TVOC. The solid adsorption tube containing Tenax TA was used to collect air sample and then analyzed by thermodesorption/GC-MS for turpentine conc.measurement. Samples were collected once a week for five consecutive weeks during March and April 2011. The occupants and ventilating condition in each classroom on sampling day was also recorded. Results: The weekly measurements showed that most of air pollutants increased gradually through the class. The average CO2 conc. in three classrooms were 752 ~1130 ppm, and the highest value was 2070 ppm. The average TVOC conc. were 5.6 ~ 6.6 ppm, and the highest measured level was 19.6 ppm. The average O3 conc. were 46.9 ~ 53.4 ppb, and the greatest detected value was 181 ppb. The average turpentine conc. were 2.59 ~6.16 mg/m3, and the highest level determined was 35.86 mg/m3. The multiple regression model showed that the number of occupants and the ventilating condition were correlated with the conc. of turpentine. Conclusions: Poor indoor air condition in university oil painting classrooms was found in this study, the conc. of CO2, O3and TVOC in three subject classrooms usually exceeded the Taiwan EPA's standards of indoor air quality. Although all levels of turpentine were quite low, but the pungent smell spread all over the classroom should be concerned. The authorities should reduce the number of students in each class and increase air change rates to improve the air quality.

Abstract Number	**P-2-08-16**
Presenter	Luca Del Buono, Andrea Spinazzè*, Davide Campagnolo, Andrea Cattaneo, Paolo Carrer, Domenico Maria Cavallo
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Indoor Air Quality in Bank Offices

Background Since the general population spends most of its time into indoor environments, the study of indoor air quality (IAQ) is of great concern for assessing the impact of indoor air pollutants on human health. Aims In this study 6 Italian bank branches, identified as “of concern” on the basis of an “IAQ-perception” questionnaire, were investigated through the measurement of PM10, PM2.5, PM1, PM0.5, PM0.25, HCHO, NO2, CO2, ACH. In order to perform a more detailed study, some other chemicals (aldheydes, terpenes, ozone) were measured in 4 of the selected bank branches. Methods The above mentioned pollutants were twice measured (in summer and winter) for 24 hours through active sampling (PM), passive sampling (VOCs, aldehydes and terpenes) or direct-reading instruments (CO2 and ozone). In each bank branch, sampling was carried out in 2 indoor offices (“teller area” and “consulting area”) and 1 outdoor location. A specific check-list has been completed, to collect also information about office construction and design, building services and local environment. Results The analysis (Paired T-Test, One-way-ANOVA, PCA) of collected data showed statistically significant differences by sampling positions, sampling sessions (summer/winter). The highest measured mean concentrations were generally observed in the teller area and during the winter sampling session. Other office characteristics (e.g. relevant refurbishment of the filial), appeared to be important in determining the indoor concentrations of some air contaminants (e.g. HCHO) Conclusions Differences in indoor air quality were observed within and between bank branches. Air pollutant concentrations were also related to spatial and seasonal variations, as well as to some specific building characteristics.

Abstract Number	**P-2-08-17**
Presenter	Kanistha Chatterjee*, Eric Kettleson, Reshmi Indugula, Patrick Ryan, Sergey Grinshpun, Gary Adamkiewicz, Tiina Reponen
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Indoor Air Quality in Green vs. Non-green Homes

Background: Green building features are designed to have a minimal negative impact on the environment and reduce energy consumption. However, the indoor air quality (IAQ) within green buildings has not yet been quantified. We assessed the indoor air quality in 20 green-renovated and 20 control apartments in Cincinnati, Ohio, USA. A 5-day IAQ assessment in each home included measurement of temperature, relative humidity and ventilation as well as concentrations of fine particles, allergens, volatile organic compounds (VOCs), and pesticides. Aims: Determine how green renovation features affect the indoor air qualityMethods: Temperature and relative humidity were monitored using continuous data loggers. Sampling for particle mass ≤ 2.5 µm (PM2.5) was conducted using single-stage Personal Modular Impactors with 37-mm, 2.0-µm pore-size PTFE membrane filters. VOC sampling was performed using passive diffusion dosimeters and pesticide samples were collected from kitchen floor by wiping. Dust samples were vacuumed from beds and kitchen floors and analyzed for allergens.Results: Preliminary data obtained immediately after renovation shows that relative humidity and formaldehyde levels were significantly higher in green vs. non-green homes (p=0.04). In contrast, isopropyl alcohol levels were significantly higher in non-green homes (p=0.05). Overall, there were higher detectable levels of pesticides in non-green vs. green homes. Additionally, we identified a trend of higher PM2.5levels in green homes (p=0.08). Higher concentrations of allergens were observed in non-green homes though the difference was not statistically significant.Conclusions: The baseline data immediately after renovation shows conflicting trends between green-renovated and renovated homes for different indoor pollutants. Follow-up sampling performed 6 and 12 months after renovation may help identify how the IAQ will change in green-renovated homes over time.

Abstract Number	**P-2-08-18**
Presenter	Ying Xu*, Yirui Liang
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	exposure modeling

Indoor Residential Fate Model of Phthalate Plasticizers

Phthalates are ubiquitous pollutants in indoor environments and have emerged as a serious public concern due to their adverse effects on humans. Using emissions of di-2-ethylhexyl phthalate (DEHP) from vinyl flooring as an illustrative example, we developed a three-compartment model to predict the fate and transport of phthalates in a residential home. The model considered eight environmental media (i.e. air, particulate matter with six size fractions, vinyl flooring, carpet, furniture, settled dust, wall and ceiling). Particle movement (deposition and resuspension), dust removal (vacuuming), indoor cooking, and adsorption/absorption on indoor surfaces are also included. The predicted airborne DEHP concentrations at steady state are within the range of 0.1 µg/m3 to 0.2 µg/m3. After vinyl flooring (the primary source) is removed, it takes 2 years for indoor airborne DEHP level to reduce to below 0.01 µg/m3, and the time doubles when carpet presents. Field measurements in a test house are conducted to validate the model, and the model predictions are of the same order of magnitude as measured data. Finally, the exposures to DEHP as well as several other phthalates via inhalation, dermal absorption from gas and deposited particles, and non-dietary ingestion of dust are evaluated. The daily exposure levels shows that several effective removal strategies might be necessary to lower the exposure level.

Abstract Number	**P-2-08-19**
Presenter	Bo Sahlberg*, Maria Gunnbjörnsdottir, Argo Soon, Rain Jogi, Thorarinn Gislason, Gunilla Wieslander, Christer Janson, Dan Norbäck
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Microbial volatile organic compounds (MVOC), plasticizers and formaldehyde in dwellings in North European cities in relation to sick building syndrome (SBS)

Background. There are few studies on associations between airborne microbial exposure, formaldehyde, plasticizers in dwellings and the symptoms compatible with the sick building syndrome (SBS). Within the follow-up of the European Community Respiratory Health Survey (ECRHS II), indoor measurements were performed in homes in three North European cities. Aim. The aim was to examine whether volatile organic compounds of possible microbial origin (MVOCs), and airborne levels of bacteria, molds, formaldehyde, and two plasticizers in dwellings were associated with the prevalence of SBS, and to study associations between MVOCs and reports on dampness and mold. Methods. The study included homes from three centers included in ECRHS II. A total of, 159 adults (57% females) participated (19% from Reykjavik, 40% from Uppsala, and 41% from Tartu). A random sample and additional homes with a history of dampness were included. Exposure measurements were performed in the 159 homes of the participants. MVOCs were analyzed by GCMS with selective ion monitoring (SIM). Symptoms were reported in a standardized questionnaire. Associations were analyzed by multiple logistic regression. Results. Totally 30.8% reported any SBS (20% mucosal, 10% general, and 8% dermal symptoms) There were positive associations between any SBS and levels of 2-pentanol (p=0.002), 2-hexanone (P=0.0002), 2-pentylfuran (P=0.009), 1-octen-3-ol (P=0.002), formaldehyde (P=0.05), and 2,2,4-trimethyl-1,3-pentanediol monoisobutyrate (Texanol) (P=0.05). 1-octen-3-ol (P=0.009) and 3-methylfuran (P=0.002) was associated with mucosal symptoms. In dwellings with dampness and molds, the levels of total bacteria (P=0.02), total mold (p=0.04), viable mold (p=0, 02), 3-methylfuran (p=0.008) and etyl-isobutyrate (p=0.02) were higher. Conclusion, some MVOCs like 1-octen-3-ol, formaldehyde and the plasticizer Texanol, may be a risk factor for sick building syndrome. Moreover, concentrations of airborne molds, bacteria and some other MVOCs were slightly higher in homes with reported dampness and mold.

Abstract Number	**P-2-08-20**
Presenter	Maud Guglielmino*, Alaa Allouch, Pierre Bernhardt, Christophe A. Serra, Stéphane Le Calvé
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Miniaturization of colorimetric and fluorimetric analyzers for the gaseous formaldehyde detection

Formaldehyde is a major pollutant of indoor air owing to its multiple sources (materials, combustion, painting, etc.). Based on a former in-house formaldehyde analyzer, two new miniaturized analyzers are being developped. The former analyzer was based on the reaction of formaldehyde with a selective derivative agent (fluoral-P) to form a fluorescent species (DDL). The analyzer measured concentrations of formaldehyde in 3 steps strongly coupled to each other: 1) the uptake of gaseous formaldehyde into an aqueous solution, 2) the selective derivatization of formaldehyde by reaction with fluoral-P, 3) the analysis of the reaction product by fluorescence spectroscopy. [1] For the next generation devices, new technologies are used for the uptake of gaseous formaldehyde and the detection. However, the reaction step remains unchanged. New molecules are in development in order to obtain better quantum efficiency. In one case, the detection is realized by colorimetry with the major benefit of no calibration requirement. In the other case, the detection is realized by fluorescence spectroscopy, the major advantage being a better and higher sensitivity than colorimetric detection. The former analyzer weighted 8 kg while future miniaturized analyzers will weigh less than 2 kg making them suitable for field analyses. These new analyzers will combine precision, selectivity towards formaldehyde, high speed analysis, information processing and communication into a single much smaller device. Finally, it will be necessary to validate the smooth running and the precision of these devices by comparison with the conventional technique of derivatization by DNPH coupled to analysis by HPLC/UV on synthetic air samples generated by a calibrated source of gaseous formaldehyde and also in real indoor atmospheres under various scenarios. References: [1] S. Le Calvé, W. Zheng, J.-L. Ponche, P. Bernhardt, Device and method for determining the concentration of a compound in an aqueous or gaseous phase, french patent, WO2010142908 (A1)

Abstract Number	**P-2-08-21**
Presenter	Shahana Khurshid*, Jeffrey A. Siegel, Kerry Kinney
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Outdoor Sources of Residential Indoor Particulate Reactive Oxygen Species

Despite the fact that precursors to reactive oxygen species (ROS) are prevalent in homes, the concentration of ROS had not been assessed in homes till a recent study by our group. Given the significant concentrations of ROS that we found in homes as well as the evidence for adverse health effects caused by ROS, it becomes important to identify and control potential sources of indoor ROS. Controlled experiments were conducted at an unoccupied test house to help determine the influence of two potential outdoor sources of indoor ROS: outdoor particles and ozone (O3) that infiltrate into homes. One of the rooms was pressurized to isolate it from the rest of the house and sampling was conducted in three different situations: (i) particle-free, O3 laden air brought into the room using a High Efficiency Particulate Air (HEPA) filter at the room's inlet, (ii) O3-free, particle laden air brought in using an activated carbon (AC) filter, and (iii) clean air brought in using HEPA and AC filters. The concentration of ROS on triplicate total suspended particle (TSP) samples was assessed with a fluorescent reagent. When the O3 concentration in the room was increased to 19 ppb, the ROS concentration in the room (1.50±0.38 nmoles/m3) was closer to the outdoor concentration (2.08±0.20 nmoles/m3) where O3 was at 40 ppb, than in the rest of the house (0.75±0.11 nmoles/m3) where O3 had remained at 3 ppb. When the PM2.5 concentration in the room was increased to 2.6 mg/m3, the ROS concentration in the room (2.26±0.42 nmoles/m3) was similar to the outdoor concentration (2.42±0.58 nmoles/m3) where PM2.5 concentration was at 3.1 mg/m3. In comparison, when no O3 or particles were brought into the room, the ROS concentration in the room (2.00±0.24 nmoles/m3) was substantially below the outdoor concentration (2.95±0.08 nmoles/m3). These results indicate that infiltration of outdoor particles and O3 into homes can strongly influence indoor particulate ROS concentrations.

Abstract Number	**P-2-08-22**
Presenter	Balducci Catia*, Paola Romagnoli, Perilli Mattia, Cecinato Angelo
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

PAHs and BTEX in schools, houses and offices of Rome, Italy.

PAHs and BTEX in schools, houses and offices of Rome, Italy. Balducci C, Romagnoli P, Perilli M, Cecinato A National Research Council of Italy, Institute of Atmospheric Pollution Research (CNR-IIA), Rome, Italy Background.Air contaminants affect the indoor environments of life of humans. They have twin origin, i.e. come from outdoors or are directly released in situ. Most investigations till now were restricted to macro-pollutants (PM, NOx, CO, BTX) and nicotine, as a consequence of tobacco smoking. Few attention was paid to organics and especially to PAHs, although genotoxic. Aim. In the frame of the EXPAH Life+ Project, aimed to assess the true exposition and health impact of PAHs on population, in-field measurements have been made in Rome, chosen as target domain. Our objective was to set up a PAH data base sufficient to assess the concentrations experienced by people during their life; concurrent indoor and outdoor measurements can elucidate the in/out penetration ratio of PAHs. More, the results were provided to Project Partners for modelling and ambient exposure/toxicity studies. Methods. Two monitoring campaigns were made in winter and spring-summer 2011-12. Three schools, one office and four houses were investigated. PAHs were our focus. Procedures developed at CNR-IIA were adopted for our study. BTEX and PM2.5 were investigated to draw information in the pollution degree at the sites. Results. PAHs affected indoor environments as long as the respective outdoors. In winter BaP could exceed the European guideline value for ambient toxicity. PAHs did not modulate in accordance to PM2.5 nor BTEX. The BTEX profiles varied site to site and in to out. Conclusions. The presence of PAHs indoors seemed to contribute to air pollution at life and work sites. The health impact of PAHs merits to be discriminated by that of other recognized pollutants, and the PAH indoor sources must be elucidated to address the policies aimed to warrant a clean air to citizens.

Abstract Number	**P-2-08-23**
Presenter	Gabriel Bekö*, Charles Weschler, Aneta Wierzbicka, Dorina Gabriela Karottki, Jørn Toftum, Steffen Loft, Geo Clausen
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Ultrafine particles: Exposure and source apportionment in 56 Danish homes

Background:Exposure to fine particles is associated with respiratory disease, cardiovascular disease and mortality. Recent studies advocate that ultrafine particles (UFP) may be of concern regarding adverse health effects. The contribution of indoor sources to the overall UFP exposure can be substantial. Aims:This work aims to characterize the indoor exposure to UFP, identify the indoor activities responsible for the exposure, and estimate the contribution of source events to the total exposure of the occupants. Methods:Particle number concentrations (PN; 10 - 300 nm in size) were continuously measured over a period of ~45 hours in 56 residences of non-smokers. The residents kept diaries on occupancy and particle related activities. The averageresidentialdaily integrated exposure was calculated and apportioned among sources. Results: The highest particle number concentrations were measured when occupants were present and awake (GM: 22.3 x 103 cm-3), the lowest when the homes were vacant (GM: 6.1 x 103 cm-3) or the occupants were asleep (GM: 5.1 x 103 cm-3). Source events resulted in increased PN concentrations and decreased average particle diameter. Exposure to elevated PN concentrations persisted for several hours after the source ceased to emit fresh particles. The residential daily integrated PN exposure ranged from 37.1 x 103 to 6.0 x 106 cm-3 h/d (GM = 334 x 103 cm-3 h/d). Close to 90% of this exposure occurred while the occupants were awake. Source events were responsible for ~70% of this exposure. Events contributing the most were candle burning, cooking, toasting and unknown events. Candle burning and cooking were responsible for more than 50% and 30%, respectively, of the integrated exposure in the homes where these activities occurred. Conclusions:The contribution of indoor generated UFP to the occupants' total UFP exposure can be substantial and shouldn't be overlooked when evaluating the potential health effects of ultrafine particles.

Abstract Number	**P-2-08-24**
Presenter	Heidrun Hofmann*, Michael Köhler, Norbert Weis
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

VOC emissions from flexible joint sealants - an underestimated building product group

VOC emissions from flexible joint sealants - an underestimated building product groupHofmann Heidrun, Köhler Michael and Weis NorbertBackground and aimsBased on different reaction systems flexible joint sealants are a very heterogeneous product group, some of them with significant emission potential. Technical requirements are in the focus of the producers interest while emission and health aspects are less considered so far.Due to a literature study promoted by the german institute for building technology (Deutsches Institiut für Bautechnik, DIBt) we first selected critical as well as less examined systems for thermo extraction and test chamber investigations. Manufacturer's instructions, data from test labs and users were considered for the study. For example 2-butanonoxime, methanol, 2-methoxyethanol, 1-aminobutane, sec. butylamine, cyclohexylamine are identified as hazardous ingredients.MethodsIn a study - also sponsored by the DIBt - 20 products were tested by using thermo extraction. Nine joint sealants were analysed by test chamber measurements according to AgBB (Comitee for health related evaluation of building products, Ausschuss zur gesundheitlichen Bewertung von Bauprodukten). The tests were carried out according to DIN EN 16000-3, -6, -9 and -11 with deviations concerning of the product sample.Results and conclusionThe total emission values by thermo extraction ranges between 28 mg/kg and 4090 mg/kg. Four products did not fulfill the AgBB standards after 28 days because of increased VOC concentrations. The trial was supported by case studies where we measured high indoor air concentrations for 2-butanoxime (> 1000 µ/m3) and benzaldehyde (> 200 µg/m3) after several month of usage.As flexible joint sealants may lead to unhealthy indoor air concentration, we recommend the emission control of this building product.

Abstract Number	**P-2-09-01**
Presenter	Lam Nicholas*, Christina Aristanti, Prianti Utami, Michael N. Bates, Indar Priyaji, Moh Zakky, Maura Lillis, Kirk R. Smith
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

A Pilot Study Evaluating Changes to Household Emissions and Health Risk Following Indonesia’s Liquified Petroleum Gas (LPG) Conversion Program

Background In 2007, the Indonesian government implemented a strategy to remove a 40-year old national subsidy on kerosene across most areas of the country. This subsidy, used by 50 million households to meet daily cooking and lighting needs, was replaced with an unconditional subsidy on liquefied petroleum gas (LPG). The motivation for this transition was economic: less LPG could be subsidized to meet public energy demand. However, since the transition began, evidence has emerged elsewhere on the human health and environment risks from household kerosene. Whether the Indonesian transition from kerosene to LPG has had unanticipated co-benefits due to reductions in exposures to health-damaging pollutants and emissions has not been formally evaluated. Aims To provide the first estimates of the Indonesian kerosene to LPG subsidy transition impacts on household pollutant emissions and human health risks for selected outcomes. Methods Household surveys were administered to 400 households within a sub-district of Yogayakarta, Indonesia, to determine fuel use habits before and after the LPG transition. In 100 households, 3-day Kitchen Performance Tests and stove-use monitoring were conducted to evaluate fuel use rates. In-house cookstove emissions were measured in 15 households representing stove and fuel combinations typical of the region. Results and Conclusions Household surveys in the study region indicated that prior to the subsidy change, 76% of surveyed houses used kerosene as their main cooking fuel. By 2012, this had fallen to 7%, in favor of LPG (79%). Charcoal-using households rose from 8% to 10% following the transition, with the increase attributable to an elderly sub-population. Although 40% of houses use subsidized fuel for small-scale businesses, they constitute 65-70% of demand. Estimates of changes to population health risks and pollutant emissions will be presented. Understanding of the effectiveness of Indonesia’s conversion to LPG may provide guidance for nations considering eliminating or reducing kerosene subsidies or its use.

Abstract Number	**P-2-09-02**
Presenter	Lopamudra Paul*, Ramesh Chellan
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	health impact assessment

Acute Respiratory Infection among children and adverse pregnancy outcome: An Impact of indoor pollution in Rural India

Background: Indoor pollution is very high in India and 65.4% households in rural India uses firewood as a cooking fuel. Childhood morbidity like ARI is also very high. Several studies show there is correlation on adverse outcome of pregnancy and use of traditional cooking fuel. In India, ¾ of population living in rural areas and exposed to indoor pollution. Aims: To assess the effect of indoor air pollution through cooking household cooking fuel on children and pregnant women in rural India. Methods: The paper analyse data on 2, 21, 245 ever married women & 85,522 children from the District Level Household & Facility Survey-3, 2007-08 in India. To assess the effect of cooking fuel along with other socio-economic-demographic factors on ARI among children & pregnancy outcome among women Logistic regression model is used. Results: There are 23% rural dwellings India has only one room and majority of them are using firewood as cooking fuel. Women & children living in lower wealth index in rural area are more likely to affect by using firewood. Educational level and castes have significant impact on use of cooking fuel, however, no. of rooms and type of fuel used are the most important factor on adverse pregnancy outcome and children suffering on ARI. The frequency of ARI incidence increases among children who are living in one room dwelling and household using firewood/cow dung and cooking fuel. Similarly, women having more of spontaneous abortions who are exposed to cooking by firewood in villages. Conclusions: To reduce the incidence of ARI and adverse outcome of pregnancy among rural children and women respectively, govt should take initiative on introducing bio-gas plant or use of solar power to cook food.

Abstract Number	**P-2-09-03**
Presenter	Aimo Taipale*, Sanna Saarikoski, Arto Pennanen, Risto Hillamo, Raimo O Salonen, Matti Lehtimäki
Exposure	ambient air pollution
Health domains	other
Type of research	others

Air filtration in buildings – a potential technique for protecting occupants against fine particles from outdoor sources

People spend almost 90% of their time indoors. Thus, the supply air filtration in buildings plays an important role in the occupant exposure to fine particles of outdoor origin. Besides supply air filtration, room air cleaner is a potential measure for reducing the health risks of urban air fine particles. The primary aim of the study was to investigate the role of air filtration when protecting occupants against fine particles from outdoor sources. Efforts were also put to improve the efficiency of supply air filtration, and to clarify the feasibility of room air cleaners. Long-term measurements were made in three locations in urban and suburban environments (school building, apartment in multistorey building, and single-family house). Sophisticated aerosol instruments together with an automatic sampling system were used to measure indoor and outdoor aerosol concentrations and size distributions (size range 0.01 – 10 mm). The results were used to determine the efficiency of air filters and indoor/outdoor (I/O) ratios for fine particles of outdoor origin. The efficiency of supply air filtration can be easily improved up to 90%, and the I/O ratio can be significantly reduced, when compared to existing practices. The uncontrolled leakage air flows in buildings, however, limit the feasibility of supply air filtration, i.e. the achieved I/O ratios (particle size 0.3 mm) were in the range of 0.2-0.3. By using room air cleaners in combination with effective supply air filtration, the I/O ratio could be further reduced, in favorable conditions even below 0.1. The concentration of indoor fine particles originating from outdoors can be effectively reduced by improving the level of supply air filtration. This requires, however, that the uncontrolled leakage air flows are negligible compared with the supply air flow. Room air cleaner, with adequate capacity and acceptable noise level, is another potential option for reducing the occupant exposure to fine particles.

Abstract Number	**P-2-09-04**
Presenter	Rebecca Close*, Rebecca Ghosh, Lucy McCann, Anna Hansell, Giovanni Leonardi
Exposure	household air pollution
Health domains	other
Type of research	cross-sectional study

Analysis of carbon monoxide hospital admissions in England – what can we learn about accidental poisoning?

Background Carbon monoxide (CO) is a known cause of fatalities and hospital admissions from accidental poisoning in the UK. We studied inpatient admissions due to CO exposure to provide a more accurate picture of the burden of disease in this setting and to contribute to establishing CO surveillance. Aim Admissions to hospital relating to carbon monoxide poisoning (ICD-10 code T58, ICD-9 code (986) were analysed in Hospital Episode Statistics (HES) inpatient data between 1998 and 2007. Results Total number of hospital admissions was 6068, an average of 674 per year. Initial results demonstrate that the regions with the highest relative risk for hospital admissions of CO poisoning compared to the England and Wales average are East Midlands (1.41, 95%CI 1.31-1.52) and Yorkshire and Humber (1.25, 95%CI 1.17-1.35). The number of male admissions (n=4063) were more than twice that of females (n=2005). The region with the highest rate of admissions for both males and females was the East Midlands (2.23 (95%CI: 2.04-2.44) and 1.04 (95%CI:0.91-1.18) respectively). Conclusions Little is known about the number of hospital admissions due to CO poisoning in England and Wales; the results of this study so far suggest a significant burden of CO and important gender and regional differences. Further analysis will examine trends over time, seasonal trends, rates by ethnicity and deprivation. A next step will be to investigate the sources and prevalence of CO exposure in the home.

Abstract Number	**P-2-09-05**
Presenter	Sankar Sambandam*, Santu Ghosh, Arulselvan Sadasivam, Rengaraj Siva, Sathish Madhav, Krishnendu Mukhopadhyay, Kalpana Balakrishnan, Hafeez Rehman, Veerabhadran Ramanathan
Exposure	household air pollution
Health domains	no health domain
Type of research	others

Assessing household level exposure reductions associated with use of improved biomass cook-stoves in India: Results from field assessments for Project Surya

Background:Cleaner cook-stoves are considered to be an important class of interventions for reducing emissions and exposures resulting from household use of solid fuels with accompanying benefits for health and climate for populations of developing countries. Few field based evaluations have however been performed to assess their efficacy. Aim:This pilot arm of Project Surya (aimed at demonstrating health and climate relevant improvements accompanying stove and fuel interventions) focused on measuring exposure reductions for select market models of improved biomass cook stoves in 2 Indian states. Methods: The study was designed as a controlled field experiment with paired measurements of 24-hour kitchen concentrations of PM2.5 and CO being performed before and after installing the improved biomass cook stoves. 6 commercial models were selected to cover stove technologies that used free/ forced convection and/or fuel processing respectively. Results:The median 24-hr kitchen concentrations of PM 2.5 were 300 µg/m3 [inter-quartile range 533 µg/m3] and 161 µg/m3 [inter-quartile range 261µg/m3] while using traditional and improved cook stoves respectively. Corresponding, median 24-hr kitchen concentrations of CO were 5.88 ppm[IQR 8.7 ppm] and 3.4ppm [IQR 5.69ppm] while using traditional and improved cook stoves respectively. Both free and forced convection models showed significant reductions in household concentrations as compared to traditional cook-stoves (ranging between 43- 67%) for both PM 2.5 and CO, with the forced convection stoves achieving the highest reductions. Conclusions: Although some models showed promise, stoves would need to be benchmarked against WHO Air Quality Guidelines to be labeled as improved as compared to traditional open fires. This is further complicated by perhaps limited use of the “improved stove” and the stove "staying improved" over time to achieve desired health benefits for exposed members of the household.

Abstract Number	**P-2-09-06**
Presenter	Anu W Turunen*, Taina Siponen, Tarja Yli-Tuomi, Pekka Tiittanen, Satu Männistö, Juha Pekkanen, Timo Lanki
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Association between household wood burning and low-grade systemic inflammation

Background Smoke originating from household and neighbourhood wood burning can infiltrate from outdoor to indoor air. Additionally, smoke can be emitted from the stove directly into indoor air. Wood smoke contains several hazardous components such as soot and ultrafine particles that are thought to induce inflammatory responses and oxidative stress. Pro-inflammatory response could be one of the mechanisms explaining adverse cardiovascular effects of particulate air pollution. Aims Our aim was to investigate whether household wood burning is associated with low-grade systemic inflammation in a cross-sectional setting in Finland. Methods The study population consisted of a sub-sample (n=2053) of the national population-based FINRISK 2007 Study. Participants were aged 25 to 74 years and lived in three geographical areas in Finland. The information on wood burning for additional heating in the respondent's household was based on self-report. Highly sensitive C-reactive protein (CRP) was analysed from blood samples, and participants with CRP<10 mg/l were included in the study. In linear regression analysis, log-transformed CRP was used as a response and the studied association was adjusted for age, sex, education, body mass index, smoking, alcohol consumption, and physical activity. Results The prevalence of regular wood burning was approximately 20%, and approximately 10% of the study population burned wood in their household irregularly. Neither regular (β=-0.053, p=0.43) nor irregular (β=-0.080, p=0.11) household wood burning was associated with serum CRP concentration. Conclusions Self-reported household wood burning appeared not to be associated with low-grade systemic inflammation.

Abstract Number	**P-2-09-07**
Presenter	H Dean Hosgood*, Christopher Farah, Janet Hock
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Biomass Burners and Respiratory Diseases: Geospatial Findings and Epidemiological Design Issues

Background.The recent Global Burden of Disease estimates identified in-home biomass burning as a leading cause of death attributed to environmental factors (about 4 million deaths/year). In the northern United States, such as Maine, residents utilize in-home wood burning stoves and are also increasingly installing outdoor wood boilers (OWBs) to meet their heating needs. OWBs generate anthropogenic particulate matter (PM2.5), and potentially other air pollutants. Little is known, however, about either the full environmental impact of OWBs, nor the potential adverse health effects. Aims.To determine if OWBs are ecologically associated with prevalence of non-malignant respiratory diseases, and to evaluate the feasibility of conducting an environmental epidemiological study of OWBs. Methods/Results. Using permit data on Maine’s industrial OWBs and 2009 outpatient data from the Maine Hospitals Data Organization, we found increased asthma and chronic obstructive pulmonary disease rates associated with proximity to industrial OWBs through geospatial buffer modeling, despite the OWBs' regulatory compliance. We identified a striking variation in the number of fuel types burnt in industrial OWBs (range 1-13). There is no permit database for residential OWBs. We extended our research to include a pilot exposure assessment and found outdoor emissions in both the particle and nanoparticle size fractions increased in the proximity of a known residential OWB. We have identified a geographically confined population that is ideal for an environmental epidemiological study of industrial and residential OWBs. We are currently developing the epidemiological protocol and refining an exposure assessment sampling strategy to include both area and personal sampling for air pollution derived from OWBs. Conclusions. Further work is needed to determine indoor and outdoor exposures attributed to OWBs in order to develop quantitative models of exposures from biomass burners.

Abstract Number	**P-2-09-08**
Presenter	Gaelle Guyot*, Romuald Jobert
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	others

BUILDING COMPULSORY REGULATION CONTROLS: A PRECIOUS SOURCE OF FIELD DATA ON VENTILATION SYSTEMS QUALITY

Air change rates in buildings are necessary to ensure a good indoor air quality, but they have to be limited because of their impact on energy performance. It is also recognized that the design of low energy buildings should be based on airtight envelopes, associated with efficient ventilation systems. In this way, the new French energy performance regulation (2012) imposes an envelope airtightness requirement for all new dwelling. However this EP-regulation does not include any requirement on ventilation rates. Aeration of dwellings depends on another 30 years old regulation. In this context, building's sector logically wonders about the risk for a generation of performing airtight dwellings, which may contribute to an unhealthy indoor air. An important issue is: what do we know exactly of the real efficiency of those ventilation systems, once they are installed and in-use in the buildings? To answer this question, we analyzed available data from building compulsory regulation controls, which concern several regulations, including energy performance and dwellings aeration. Analysis of the dysfunctions observed on a sample of 1287 dwellings allows us to raise an accurate picture of ventilation systems quality on sites. From a global point of view, we observed that 68% of the single-family dwellings, and 44% of the multi-family dwellings of the sample, do not comply with the regulation. From a finer point of view, it is possible to understand more specifically what are the underlined technical and organizational reasons. This original first analysis represents an essential step towards the final goal: find solutions for increasing ventilation quality. First, the paper presents the regulation compulsory controls and why they drive to a precious database. Then, it gives an overview of the analyzed sample. Finally, results of the detailed analysis of dysfunctions compilation are presented, leading to some proposals for improving ventilation system mounting.

Abstract Number	**P-2-09-09**
Presenter	Cong Liu*, Yinping Zhang, John C. Little
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure modeling

Can ventilation reduce indoor exposure to SVOCs?

Background The resulting human exposure to certain semi-volatile organic compounds (SVOCs) has been found to be associated with adverse health effects. We wonder how ventilation works to mitigate indoor exposure to SVOCs. There are limited studies addressing this issue. Aims We aim to examine the influence of ventilation on SVOC concentration in the air. Methods A mass balance model was developed to describe the accumulation of SVOCs. We normalized the SVOC concentration by y0 for the convenience of further study. The influence of ventilation on indoor particle mass concentration and the effect of particle mediation on enhancing gas-surface mass transfer are included in the model. Results The model presented here is validated with the experimental data reported in literatures. The SVOC concentrations decrease as ventilation rate increases, vice versa. The airborne concentration at steady state would only change by approximately 50% when ACH is varied by a factor of 3 with a baseline condition of 0.6/h. Considering the kinetics of gas/particle interaction will not significantly alter the influence of ACH on steady-state Cairborne. Conclusions Increasing ventilation has limited influence on airborne SVOC concentration.

Abstract Number	**P-2-09-10**
Presenter	Xiaojian Xie*, Xiaoyu Shen, Hu Huang, Mei Liao, Wan Hu
Exposure	household air pollution
Health domains	other
Type of research	exposure measurement

Carbon dioxide concentration levels and ventilation rates of naturally ventilated university classrooms in the hot summer and cold winter area of China

Poor indoor air quality has been shown to bring a negative influence to students' learning performance and human health. Most college students in China spend more than 10 hours each day having lessons and studying in classrooms of teaching buildings, which originally designed to be mechanically ventilated with ceiling fans. Unlike in the northern China, there is no heating system for classrooms during winter in many cities of hot summer and cold winter area. Recently wall-mounted split units without fresh air introduction were installed just in some classrooms to provide air conditioning. Thus all the doors and windows of classrooms are closed when being occupied in winter to compromise thermal comfort. Complaints about poor IAQ are very common in university classrooms. Reasons for high levels of CO2 concentrations are dense opulation and inadequate ventilation, in some cases of which can beblamed on the building design. Investigation of IAQ and ventilation performance in classrooms of this area would provide valuable information for future teaching building design and natural ventilation utilization in universities. In this field study CO2 concentration were monitored in classrooms of a typical teaching building in Nanjing city, and then ventilation rates were estimated. The findings show that these classrooms have lower average CO2 concentration levels (981 ppm) in May compared to that in November (1838 ppm) which is higher than recommended in several standards. A peak reading of 4500 ppm was observed during an examination when all the doors and windows closed. It was confirmed that with windows or doors shut, the classrooms would not have sufficient ventilation. Just opening the corridor windows could not efficiently reduce indoor CO2 concentration, while opening top-hung windows works without influencing thermal comfort, which need further study. Window type is very important for good natural ventilation performance. These types of classrooms and buildings are widespread and results found here may apply elsewhere in many other cities in China.

Abstract Number	**P-2-09-11**
Presenter	Ntsoaki Malebo*
Exposure	food
Health domains	healthrelated quality of life
Type of research	occupational study

Characterization of microorganisms colonizing ventilation grills at South African Hospitals

Background The vital role HVAC systems play in healthcare settings is known. Bioaerosols can spread from HVAC sites resulting in exposure to indoor surfaces and building occupants. The presence of bioaerosols in indoor hospital environments can possibly place patients at greater risk as they can confine and allow aerosols to build up to infectious levels leading to hospital acquired infections (HAI). HAIs can place strain on limited financial resources allocated to health delivery. Recent evidence suggests an increase of infectious disease contracted via the aerial route from particles possibly distributed through HVAC systems. Sampling of HVAC systems and characterization of isolated microorganisms thus becomes essential as they affect the indoor environment air quality. Aims Quantification and characterization of microorganisms colonizing grills of HVAC systems Methods Samples from ventilation grills were collected using sterile swabs. A 5X5 cm area of the outlet of the ventilation system facing each ward was swabbed. Microorganisms were identified and characterized using Matrix-Assisted Laser Desorption-Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) and Scanning Electron Microscopy (SEM). Results In general bacterial microbial counts from sampled HVAC systems were above 12cfu.cm-2 while fungal counts were below 5cfu.cm-2. According to the guide to monitoring surface hygiene (2010), when a 5X5 cm area is sampled, the current results ranged from clean (<5) to very contaminated (>10). Using the MALDI-TOF MS, identified microbes included bacterial genera Bacillus and Arthrobacter, yeast genus Rhodotorula and Penicillium chrysogenum. P. chrysogenum was further characterized using SEM. Conclusions High bacterial counts were worrying due to implications of their presence.MALDI-TOF MS is a rapid, inexpensive and effective method for microbial characterization in healthcare settings. Scanning Electron microscopy is needed for morphological characterization of filamentous fungi when inconclusive results are obtained.

Abstract Number	**P-2-09-12**
Presenter	Marwa Zaatari*, Jeffrey A. Siegel, Josh Aldred
Exposure	others
Health domains	healthrelated quality of life
Type of research	exposure modeling

Chronic health risks in retail buildings and their dependence on ventilation rates and filtration efficiencies

Background-Inhalation exposures to indoor pollutants in non-residential environments contribute largely to total daily exposures. Prioritizing pollutants to be controlled by energy-intensive methods (i.e.ventilation and filtration) is key to reducing the total chronic disease burden and achieve energy efficiency in retail buildings. Objective-Our objective was to model exposure to indoor pollutants measured in retail environments for customers and employees, and assess the role of ventilation and filtration in mitigating this exposure. Methods-Measured concentrations of pollutants in 140 stores in the U.S., available methods (IND and ID approaches) and toxicological data were employed in Monte Carlo simulations to calculate disability-adjusted-life-years (DALYs). Indoor emission factors for pollutants were calculated to assess the change in health risks under 9 scenarios of ventilation rates and filtration efficiencies. Results were compared with DALYs found in residences. Results-The estimated average DALYs due to PM2.5 and acrolein exposure contributed the largest to annual health impacts, with an estimated 122 DALYs per 100,000 persons, divided equally between PM2.5 and acrolein.Carbon tetrachloride, formaldehyde and ozone accounted for the vast majority of the cancer health effects, contributing for a total of 10 DALYs per 100,000 persons annually. Increasing the filtration efficiency, while reducing infiltration rate to a minimum, is found to be the most energy efficient method to decrease DALYs from PM2.5 exposure. As for acrolein, increasing the ventilation rates in the retail stores could not drive acrolein concentrations below the OEHHA chronic REL. Comparing the findings from this study to DALYs reported by Logue et al. (2012) for residences revealed that PM2.5 and acrolein are two common contaminants of concerns.Conclusions-This study found that polluatnt control startegies should focus on mitigating exposure to PM2.5 and acrolein. Cumulative health burden from all indoor pollutants contributed to 146 DALYs per 100,000 persons annually.

Abstract Number	**P-2-09-13**
Presenter	Santosh Gaihre*, Sean Semple, Steve Turner
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Classroom air quality and pupil attendance and attainment in Aberdeen primary schools

Background and Aims. In addition to indoor pollutant exposures at home, children are also exposed to many of the same pollutants at school and these have been linked to health outcomes. Few studies from the USA and Europe have reported association between reduced ventilation and poorer educational attainment. However, relatively a paucity of information is available to quantify the association in primary school in UK. At this backdrop, we test the hypothesis that classroom carbon dioxide concentration, as an indicator of ventilation rates are inversely related to child school attendance and educational attainment in a cross-sectional study. Methods. Ventilation rates were derived from concentrations of CO2 which were measured over a 3-5 day period in classrooms of children aged 6-7 and 10-11 years. Ventilation rates were related to the class average annual attendance and proportions attaining a national standard for reading, writing and numeracy. Results. Ventilation rates were calculated for 60 naturally ventilated classrooms. The median (interquartile range, IQR) ventilation rate was 7.1l/s/person (5.4, 9.6) and median (IQR) CO2 concentration averaged over the school day was 1122ppm (592-2115). There were positive correlations between classroom ventilation and attendance (rho 0.491 p<0.001) and reading attainment (rho 0.271, p=0.037) but not writing or numeracy. When socioeconomic factors were considered, attendance rose by an average of 0.18% [95% CI 0.06, 0.30] for each l/s/person increase in classroom ventilation. Conclusion. These results provide support for clear association between elevated level of classroom CO2 concentrations and reduced school attendance and reading score. What is unclear is whether poor ventilation directly affects attendance and cognitive ability or is simply a marker for increases in other indoor air pollutants which may produce these effects. There is a need for an intervention study to examine the benefits of increased classroom ventilation in schools.

Abstract Number	**P-2-09-14**
Presenter	Mann Jennifer*, Lisa M. Thompson, Kirk R. Smith, Carolina Romero, John R. Balmes
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Cooking with an open woodfire is associated with short-term increases in blood pressure and pulse among rural Guatemalan women

BACKGROUND: Several studies have demonstrated a relationship between exposure to outdoor air pollution or secondhand tobacco smoke and increased blood pressure. Fewer studies have explored the impact of household air pollution from cooking with biomass fuels. METHODS: We measured blood pressure and pulse among 388 young, non-smoking, women in rural Guatemala who participated in a follow-up study of a chimney stove intervention trial. Although all women had a chimney stove during the follow-up period, 16.8% of women reported use of an open fire to cook their most recent meal on the day of blood pressure measurement. We used multivariate linear regression models to explore the relationship between open fire in the past 24 hours and blood pressure. We adjusted for time-varying and fixed covariates and included random intercepts for each mother. RESULTS: Cooking with an open fire instead of a chimney stove within a 24 hour period prior to blood pressure measurement was associated with a 1.43 mmHg increase in diastolic blood pressure (95% CI=0.19 to 2.68), a non-significant 0.81 mm Hg increase in systolic blood pressure (95%CI= -0.47 to 2.09) , a 1.19 mmHg increase in mean arterial pressure (95% CI=0.03 to 2.35), and a 1.83 beats per minute increase in pulse rate (95% CI=0.38 to 3.28) after adjustment for age, body mass index number of children, maternal education, history of smoking, dirt floor in home, being the primary cook for the household, daily average temperature, season, day of week, and time of day. DISCUSSION: In this population of young women, recent use of an open fire was associated with statistically significant increases in blood pressure and pulse rate. These results show that transient acute increases in biomass smoke exposure are associated with elevated blood pressure, even in normotensive women.

Abstract Number	**P-2-09-15**
Presenter	Nadja Lyng*, Elvira V. Bräuner, Helle Vibeke Andersen, Lars Bo Gunnarsen
Exposure	persistent organic pollutants
Health domains	other
Type of research	exposure measurement

Effect of ventilation on PCB concentration in indoor air in a contaminated classroom

Effect of ventilation on PCB concentration in indoor air in a contaminated classroom PCBs (Polychlorinated Biphenyls) were used as plasticizers in construction products from 1950. As early as the seventies it became known that the use of PCB had adverse environmental and health consequences, until usage was finally banded during the 1970s. Regardless of the prohibition of PCB usage no attempt has been conducted to remove existing PCB contaminated materials until recently. Today, some thirty-five years later, renovation of PCBs in building materials is difficult since PCBs have diffused from primary sources such as sealants to their surrounding materials (secondary sources). Additionally PCBs emitted to air, have polluted surfaces exposed to the air containing PCBs (tertiary sources). The hypothesis of this study is that increased ventilation causes decreased indoor air concentrations of PCBs in a contaminated room where only tertiary sources are active. This intervention study was conducted in a highly contaminated classroom in a Danish primary school. Tertiary sources alone sustained an indoor air PCB total concentration of 2100 ng/m3. The intervention was an increase in the air exchange rate from 0.2 h-1 (no mechanical ventilation) to 5.5 h-1. The concentration of PCBs in indoor air was lowered to 1400 ng/m3 according to increased ventilation. Nevertheless, the concentration did not reach below the required action level in Denmark of 300 ng/m3 and our results indicate high pollution rates from tertiary sources such as walls, ceiling, and flooring. Although PCB levels were reduced considerably according to the higher ventilation rates established during this investigation, these did not effectively lower PCB levels to below 300 ng/m3. In other cases with lower intensities of tertiary sources, removal or enclosing of primary sources and increased ventilation might effectively remove PCB levels to below the Danish action value of 300 ng/m3.

Abstract Number	**P-2-09-16**
Presenter	Ming-Yie Liu*, Se-Ping Chien, Chih-Ching Chang, Dur-Zong Hsu, Perng-Jy Tsai
Exposure	organic compounds
Health domains	respiratory disease
Type of research	health impact assessment

Exposure of scented candle combustion aerosol on stress-induced cadiopulmonary injury

Background: Social stress may induce cardiopulmonary injury by disrupting the body's homeostasis. Scented candles have been used to relieve stress. However, numerous air pollutants produced from burning scented candles may cause poor health outcomes. Aims: To investigate effects of scented candle combustion products exposure on social stress-induced cardiopulmonary injury in mice. Methods: Mice with social disruption stress (SDR) were exposed to combustion products of 3% lavender scented candles (4.5 h/d, 5 d/wk) in an exposure chamber for different time course (4 or 8 wk). Results: Exposure to combustion products of scented candle failed to reduce serum corticosterone level in SDR-treated mice in 4 and 8 weeks. Exposure to combustion products of scented candle time-dependently enhanced SDR-induced pulmonary edema, tumor necrosis factor (TNF)-alpha, interleukin (IL)-6, interleukin (IL)-1beta levels, and nuclear factor (NF)-kB activity in lung. Further, combustion products of scented candle time-dependently increased lactic dehydrogenase, creatine phosphokinase, and heart type creatine kinase isoenzyme levels in serum, hypoxia-inducible factor (HIF)-1alpha, and B-type natriuretic peptide levels in SDR-treated mice. Conclusions: Exposure to combustion products of 3% lavender scented candle may time-dependently exacerbated social stress-induced cardiopulmonary injury.

Abstract Number	**P-2-09-17**
Presenter	Eun-Kyo Park*, HyeSook Park, Yun Chul Hong, Mina Ha, Yangho Kim, Byung-Mi Kim, Eunjeong Kim, Eun-Hee Ha
Exposure	ambient air pollution
Health domains	allergies
Type of research	cohort study

Formaldehyde exposure and allergic disease: MOthers and Children's Environmental Health (MOCEH)

Background and aims: This study investigated the association between Formaldehyde exposureand allergic disease of infants for case-control studies based in a defined cohort. Methods : We collected the eligible data of 1,751 pregnant women who were enrolled in birth cohort of having allergic disease (asthma, allergic rhinitis, atopic dermatitis) at either 12 or 24 months. The control group does not have allergic disease in follow-up period. We measured HCHO through direct home visiting for 54 household infants (35 Case group of allergic disease and 19 control group). Results : The mean levels of indoor and personal HCHO were 23.1 $\mu g/m^3$ and ? $\mu g/m^3$,respectively. The mean concentration of indoor HCHO was higher in allergic disease group (31.99 $\mu g/m^3$) than in the control group (14.94 $\mu g/m^3$)($p<0.05$). Also, the mean concentration of personal HCHO in allergic disease group (54.04 $\mu g/m^3$) was higher than in the control group(40.22$\mu g/m^3$)($p<0.05$). Personal HCHO exposure was significantly associated with an increased risk of allergic disease of infants adjusted for gender, family history and indoor TVOC concentration (Adjusted OR 1.06; 95% CI 1.00 to 1.13). Conclusion :HCHO exposure may contribute to develop allergic disease. Therefore, infant's parent should make an efforts to reduce the HCHO exposure of home environment . Acknowledgment : This study was supported by the National Institute of Environmental Research, Republic of Korea

Abstract Number	**P-2-09-18**
Presenter	Kim Angelon-Gaetz*, Karin Yeatts, David Richardson, Steve Marshall
Exposure	others
Health domains	respiratory disease
Type of research	exposure measurement

"Free to Breathe, Free to Teach" study: Determinants of Relative Humidity Control in Schools

Background Indoor dampness leads to respiratory illnesses and other health problems. Proposed mechanisms include atopic responses to allergenic organisms thriving on excess moisture or inflammatory responses to irritants produced by mold and indoor chemical pollutants. Reduction of allergens and irritants can be achieved by maintaining indoor relative humidity between 30 and 50%. However, adhering to these recommendations may be challenging for schools, especially in the humid climate of our study area. Aims The "Free to Breathe, Free to Teach" study assessed how many classrooms in each public school had "controlled relative humidity" (30-50%). Associations between school-wide humidity control and indoor air quality (IAQ) factors (building age, ventilation and maintenance practices, and previous water damage) will be presented. Methods At the start of follow-up, classrooms and common areas (N=248) were inspected according to the Environmental Protection Agency's IAQ Tools for Schools Walkthrough Inspection procedures. Relative humidity and temperature were continuously measured in 134 classrooms for 4-12 weeks using programmable, data logging hygrometers. Results Sixty eight classrooms maintained a controlled average daily relative humidity within the recommended range for over half of classroom follow-up (proportion of days with uncontrolled relative humidity =48.8%, σ=19.5%). At the same time, outdoor relative humidity ranged from 34 to 96%. After controlling for outdoor conditions, further results relating classroom relative humidity to structural factors and maintenance practices will be presented. Conclusions Preliminary results suggest that substantial improvement in classroom humidity control is necessary. A clearer understanding of factors affecting indoor humidity may assist school administrators in obtaining better control over relative humidity in classrooms and may suggest changes needed to achieve recommended standards for better indoor air quality in schools.

Abstract Number	**P-2-09-19**
Presenter	Kai-Jen Chuang*, Hsiao-Chi Chuang, Lian-Yu Lin
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Household Particles, Coffee Consumption and Heart Rate Variability

Background: The association between ambient particulate matter and heart rate variability (HRV) has been well-documented. Little is known about the association of HRV with household particles and coffee consumption. Aims: The aim of this study was to investigate the association of HRV indices with household particles and coffee consumption. Methods: We recruited 30 young healthy participants to monitor household PM2.5 (particulate matter with an aerodynamic diameter ≤ 2.5 μm) exposures and coffee consumption (yes vs. no) and HRV indices. We used linear mixed effects models to assess the associations of HRV indices with household PM2.5 exposures and coffee consumption. Results: We observed the inverse association between household PM2.5 exposures and HRV indices, with a decrease in all HRV indices with increased household PM2.5 exposures. The decrease was most pronounced at 4-hr time-weighted moving average, where an interquartile range (IQR) increase in household PM2.5 was associated with a change of -6.92% 5-min standard deviation (SD) of normal-to-normal intervals for 5-min segment (SDNN) and -5.77% 5-min square root of the mean squared differences of successive intervals for 5-min segment (r-MSSD). Effects of household PM2.5 on HRV indices were lowest for participants with coffee consumption. Conclusions: Household PM2.5 exposures were associated with decreased 5-min SDNN and 5-min r-MSSD. The effect of household PM2.5 on HRV indices may be modified by coffee consumption in young healthy participants.

Abstract Number	**P-2-09-20**
Presenter	Philomena M. Bluyssen*
Exposure	others
Health domains	healthrelated quality of life
Type of research	review

How to assess occupants' health and comfort in buildings?

Relationships between indoor building conditions and wellbeing of occupants are complex. Many indoor stressors can exert their effects additively or through complex interactions. Exposure to these stressors can cause both short-term and long-term effects. Relevant relations between measurements of chemical and physical indoor environmental parameters and effects have been difficult to make. To increase the chance on successful assessment of cause-effect relationships, there is a need to improve procedures applied to gather the relevant information. First, it is essential to understand the mechanisms behind how and why people respond to external stressors. The next step is then to determine which parameters or indicators can be used to explain these responses and how to assess those. Only when the picture is more clear, procedures can be improved in such a way that the chances to successfully assess the effects caused by different stressors (or combination of stressors) increase. The following questions are thus important to discuss: How and why do people respond to external stressors? How can health and comfort in the indoor environment be evaluated? What do we need to assess and/or predict the effects or responses? A book has been written as an attempt to answer these questions, comprising of three parts: I Mechanisms: exploring the mechanisms of response to external stressors, including aspects such as acute/long term effects, psychological/physical stressors, personal factors and history. II Assessment: discussing different assessment techniques of indicators and parameters (from responses) to external stressors, including aspects such as study design, statistical relevance and assessment techniques. III Analysis: presenting current available performance indicators for healthy and comfortable indoor environments, available information on cause-effect relations for different scenarios (schools, homes and offices), assessment and modelling techniques.

Abstract Number	**P-2-09-21**
Presenter	Masamichi Hanazato*, Emiko Todaka, Hiroko Nakaoka, Hiroshi Seto, Chisato Mori
Exposure	household air pollution
Health domains	other
Type of research	exposure measurement

Lowering TVOC is necessary to prevent sick building syndrome

Background: Sick-building syndrome (SBS) is a range of symptoms such as eye irritation, sore throat, and headaches that occur when entering a newly constructed or remodelled building. Volatile organic compounds (VOCs) are suspected to be one of the major causes of SBS. Therefore, the Ministry of Health, Labour and Welfare of Japan set the indoor air guideline values about 13 VOCs to prevent SBS. However, the number of the SBS patients has not decreased although the concentration levels of the 13 VOCs have become extremely low in recent years.Aims: The aim of this study is to examine the kind of VOCs and the concentration level of the total VOCs (TVOCs) in the current houses and buildings.Methods: Chemiless Town is a model town constructed under the concept of "Environmental Preventive Medicine" in the campus of Chiba University, Japan. In Chemiless Town, in which houses and buildings are constructed with as fewer chemicals as possible, eight Laboratory Houses (LHs) were set up for the purpose of researching the VOCs from building and interior materials. To find the causing chemicals of SBS, 81 VOCs in indoor air of the 29 rooms of the LHs were analyzed and calculated from April 2007 to December 2012.Results: The concentration levels of each VOC were extremely variable depending on the materials of the houses and the seasons. When TVOC concentration value was higher than 1,000μg/m3 or below 100μg/m3, 75% of the TVOCs was the 10 highest concentration levels of VOCs. Also, when TVOC concentration value was higher than 1,000μg/m3, 75% of the TVOCs was occupied by unregulated VOCs.Conclusion: It is important to lower the TVOCs to prevent SBS; however, it is difficult if only 13 regulated VOCs are analyzed. To lower the TVOCs, unregulated VOCs also should be analyzed and lowered.

Abstract Number	**P-2-09-22**
Presenter	Eusébio Conceição*, Cristina I. M. Santiago, Mª. Manuela J. R. Lúcio
Exposure	household air pollution
Health domains	other
Type of research	occupational study

Numerical Study of the Internal Air Quality in Classroom Equipped with Personalized Ventilation

The indoor air quality in spaces with high occupation level should be detailed analyzed. In these cases the airflow rate renovation and the air terminal devices should be correctly designed. The personalized ventilation, with one air terminal device, localized near the breathing area, was introduced in the last years, in order to increase the occupants air quality level. However, recent studies developed new personalized ventilation systems, that increase simultaneously the indoor air quality and the thermal comfort levels, with low local thermal discomfort level. In this study the air quality, the thermal comfort and the local thermal discomfort levels, that 6 and 12 seated occupants are subjected in a classroom with desks equipped with personalized ventilation systems, are evaluated. One virtual school classroom, 6 and 12 virtual thermal manikins, 6 virtual desks equipped with upper and lower air terminal devices are used, while a coupling multi-nodal human thermal response numerical model with a computational fluid dynamics numerical model, using the RNG turbulent model, are used in the numerical methodology. The thermal comfort level in this non-uniform environment is evaluated by the developed multi-nodal human thermal response numerical model, while the air quality level, the local thermal discomfort level and the airflow around the occupants are evaluated by the computational fluid dynamics numerical model. In accordance with the obtained results, is verified that the ascendant airflow, promoted by the occupant's natural convection and by the forced air terminal devices, guarantee an uniform airflow around the occupants. The highest air velocity value and the lowest air temperature are verified in front to the occupants. The air quality level is acceptable, the thermal comfort level is higher when 12 occupants are considered than when 6 occupants are considered and the local thermal discomfort level is also acceptable.

Abstract Number	**P-2-09-23**
Presenter	Helena Krasnov*, Michael Friger, Alina Vodonos, Itzhak Katra, Luna Avnon, Victor Novack
Exposure	household air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Real-time indoor PM measurements during dust storms and the association with lung function in COPD patients

Background. Environmental health research focused on outdoors particular matter (PM) exposure, yet studies indicate that most of the PM exposure occurs indoors. While indoor is affected by outdoor PM, it can be influenced by additional indoor factors. Dust storm (DS) originated PM were suggested to be a significant risk factor for pulmonary morbidity. During the DS patients can be exposed to the extremely high PM even indoors. Aims. Analysis of the association between outdoor and indoor PM during DS and none-DS days, and the effect of the desert dust exposure on patients with Chronic Obstructive Pulmonary Disease (COPD). Methods. Population comprised 86 patients with moderate-severe COPD residing in Beer Sheva city (Negev desert, Israel). Concentrations of PM10, PM2.5, and PM1 were measured inside and outside household during none-DS and DS days. A multivariate regression analysis was used to assess factors associated with indoor PM concentration. Pulmonary function tests were done at the baseline and after the DS. Results. First results (74 households) show very high indoors PM concentrations during DS; PM10 levels reached 1000 µg/m3 while the outdoor levels were 2000 µg/m3. A much stronger correlation was found between outdoor and indoor levels during DS compared with none-DS day: PM10 (DS day: r=0.733, P<0.05 vs. none-DS day: r=0.38, P<0.05), PM2.5 (DS day: r=0.741, P<0.05 vs. none-DS day: r=0.273, P<0.05), PM1 (DS day: r=0.678, P<0.05 vs. none-DS day: r=0.551, P<0.05). The multivariate analysis showed that indoor PM is influenced by outdoor PM and pets presence. FEV1 (forced expiratory volume in 1 second) during DS day was lower in average by 10% than at the baseline. Conclusions. Indoor PM concentrations increase significantly during DS events with a strong correlation to the ambient air. During DS days there is a worsening in lung function of COPD patients, despite the fact the patients spend most of their time indoors.

Abstract Number	**P-2-09-24**
Presenter	Mari Turunen*, Kati Iso-Markku, Maria Pekkonen, Ulla Haverinen-Shaughnessy
Exposure	no exposure
Health domains	other
Type of research	cross-sectional study

Results from a national housing quality, health and safety questionnaire

Background and aims Area of housing and construction are important both socially and economically, but current information about housing quality, health and safety is limited. Some relevant population based data may be gathered by questionnaires. This paper reports findings on multiple housing factors and their impact on health of Finnish adults based on a national questionnaire survey.Methods The housing and health questionnaire was sent to a sample of 3000 people who were randomly selected from Finnish Population Registry. The questionnaire included a total of 100 questions. In total 1308 people (44 %) responded.Data were analyzed using the SPSS statistical software by cross tabulation and logistic regression. Seven factors generally known to have possible effects on health were included in this study: crowding, drinking water quality, indoor air quality, ventilation, thermal conditions, dampness and mould, and noise. Studied health outcomes included general health status, general symptoms, respiratory tract symptoms and infections, asthma, sleeping disorders, eye and skin symptoms, and residential accidents.Results and conclusions Preliminary results show significant association between all selected housing factors and certain symptoms, excluding drinking water quality. For example, respondents who were not satisfied with indoor air quality (IAQ) inside their homes reported significantly more general symptoms, respiratory tract symptoms and infections than those who were satisfied with IAQ. Residents perceiving to have good thermal conditions reported better health status, less general symptoms, and less upper and lower respiratory tract symptoms than those who perceived their homes to be excessively warm or chilly, draughty, or having cold floor surfaces.It appears that an extensive national housing and health questionnaire can be used to acquire relevant information about the extent of housing health and safety problems and also about their consequences.

Abstract Number	**P-2-09-25**
Presenter	Atsushi Mizukoshi*, Takahiko Iida, Rumi Konuma, Tomoko Hamano, Kensuke Kawarada, Miyuki Noguchi, Yukio Yanagisawa
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Risk assessments of TVOC compositions in new buildings

Background VOCs in indoor environments are still one of the risks of adverse health effects including Sick-Building Syndrome (SBS) and Chemical Sensitivity (CS). In Japan, indoor VOC concentration regulated by government has decreased dramatically through the reduction efforts by industry. However, the total VOC (TVOC) concentration in new buildings has not always decreased because alternative chemicals have come to be used. Therefore, in order to conduct countermeasures for the reduction of TVOC, more information such as the chemical compositions and the health risks involved, are needed. Aims To carry out risk assessments of TVOC, the risks of TVOC compositions in new buildings were assessed using chemical databases search and semi-quantitative analysis. Methods VOCs were collected in adsorbent materials by a pump (using the flow rate of 100 ml/min) for 30 minutes in three new buildings and analyzed by TD-GCMS (Agilent technologies). Identifications of VOCs were conducted by MS library search using the MSD Chemstation (Agilent technologies) and if the agreement ratio to databases (NIST08) was over 70%, the VOC was assumed to be identified. The concentrations were calculated by toluene conversion. Additionally, the estimated human NOAEL of each compound was investigated and the MOE (Margin Of Exposure) and HI (Hazard Index) were calculated. Results In the TVOC, the risks of 11-29 compounds were estimated and the concentration ratios of these compounds were 27-78%. The MOEs of p-dichlorobenzene and 2-butanone oxime were under 10. Moreover HI was higher than 1 in one room. Conclusions Although it is difficult to know the risks of all the compounds included in TVOC, a portion of risk of the TVOC was estimated and the high risk compounds and their locations were predicted. This information is now available to determine the order of priority of the target compounds and locations which should be dealt with from a risk standpoint.

Abstract Number	**P-2-09-26**
Presenter	Mihoko Mori*, Tatsuya Ishitake, Tsuyoshi Saga, Koichi Yamaki
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Sex-based differences in subjective symptoms among medical students exposed to low-levels of formaldehyde in a gross anatomy dissection course

Background In our university, large-scale renovation for the installation of dissection tables equipped with local ventilation systems and the renewal of the general ventilation system was carried out in 2011 to reduce exposure of students to formaldehyde (FA) during a dissection course. These renovations caused the indoor FA levels to decrease dramatically. Not many reports are available on the health effects of a low FA level on medical students. We believe that there is a need to develop further strategies to reduce FA exposure in a low FA level environment. Women generally reported more health conditions than men. Therefore, we need to analyze the results according to sex. Aims To study the changes in subjective symptoms of medical students before, during, and 6 months after completion of the course according to sex. Methods We investigated the prevalence of 24 subjective symptoms in medical students before the start of a gross anatomy dissection course, during the course, and 6 months after completion of the course by using 2 self-administered questionnaires. Students completed the first survey at the end of the course, which focused on symptoms before and, during the course. The second survey was completed 6 months after the course ended. We investigated the difference in the pattern of subjective symptoms reported by men and women during 3 periods. Results The prevalence of most subjective symptoms was the lowest 6 months after completion of the course. Based on sex, the prevalence of most subjective symptoms was higher in women than in men during and 6 months after the course. The number of symptoms 6 months after the course was 17 in men and 5 in women, which indicated a significant decrease compared with the symptom prevalence during the course. Conclusions Our results indicate that the prevalence of subjective symptoms in women continued to be higher than in men 6 months after course completion. A countermeasure needs to be developed especially for women.

Abstract Number	**P-2-09-27**
Presenter	Chunyu Xu*, Dongqun Xu, Na Li, Tiantian Li, Xia Lin, Qin Wang, Yunpu Li
Exposure	household air pollution
Health domains	allergies
Type of research	cross-sectional study

Study on the association of indoor air pollution with exhaled nitric oxide of asthma children

Background: Exposure to outdoor air pollutant can induce air way inflammation and exacerbation of asthma in children. However, there is limited knowledge about the effects of exposure to indoor air pollutants, such as formaldehyde, Volatile Organic Compounds, PM2.5 and nitrogen dioxide. Aims: The aim of this study was to investigate the association of exposure to indoor air pollution and nitric oxide in exhaled air (FeNO) as a biomarker of airway inflammation of asthma children. Methods: We conducted a population-based cross-sectional study of 60 asthma children aged 6-13 years in Beijing. Formaldehyde, volatile organic compounds (benzene, toluene, butyl acetate, styrene, ethyl benzene, xylenes, n-undecane), nitrogen dioxide and PM2.5 (during 1 week) in indoor air were assessed. FeNO, a marker of airway inflammation, was detected after indoor air pollutants sampling. We examined associations between the pollutants and FeNO using logistic regression models. Results: We observed significant relationship between FeNO and indoor nitrogen dioxide and styrene and the correlation coefficients for Spearman rank correlation test were 0.340(P=0.010) and 0.335(P=0.011) respectively. After Adjustment for confounding factors using logistic regression models, such as age, asthma type, use of medicine and so on, the relationship between FeNO and concentrations of nitrogen dioxide was still significant(P=0.026). Conclusions: Our findings suggest that exposures to pollutants in indoor air may be implicated in children asthma, even in the case of low exposure. We should pay enough attention to indoor air quality.

Abstract Number	**P-2-09-28**
Presenter	Thomas Bateson*, Glinda Cooper, Barbara Glenn
Exposure	organic compounds
Health domains	cancer
Type of research	review

Systematic review of the epidemiology literature on formaldehyde and cancers of the upper respiratory tract

Background: The U.S. EPA, through the IRIS Program, is currently drafting a Toxicological Review of formaldehyde. As part of the comprehensive evaluation of potential hazards associated with exposure to formaldehyde, the potential hazards for cancers of the upper respiratory tract are being evaluated. We are aware of multiple meta-analyses which have addressed potential associations; however, EPA is conducting an independent review. Aims: To systematically evaluate the epidemiologic literature describing potential associations between formaldehyde exposures and the occurrence of cancers of the upper respiratory tract. Methods: We searched three large databases (PubMed, Web of Science and Toxline) for epidemiologic literature on specific cancers of the upper respiratory tract potentially related to formaldhyde exposure, and reviewed more than 150 studies. EPA prepared figures detailing the literature search process and summarized the relevant evidence in tables and enriched multidimensional forest plots for four specific cancers including nasopharyngeal, sinonasal, oro/hypo-pharyngeal, and laryngeal. Results: The final result of the literature search identified more than 30 relevant epidemiologic studies detailing the presence and absence of associations between formaldehyde exposure and the occurrence of cancers of the upper respiratory tract. Forest plots with extensive annotation are used to depict the results graphically. Conclusions: There is a substantial body of epidemiologic literature to address the potential association between formaldehyde exposures and certain subtypes of lymphohematopoietic cancer. Detailed graphical presentation of study results can aid in assessments of consistency by distinguishing between negative and inconclusive results and between random heterogeneity and inconsistency across study results potentially attributable to difference in study designs, populations, and exposure ranges among other factors. Disclaimer: This abstract does not necessarily reflect EPA policy.

Abstract Number	**P-2-09-29**
Presenter	Thomas Bateson*, Glinda Cooper, Barbara Glenn
Exposure	organic compounds
Health domains	cancer
Type of research	review

Systematic review of the epidemiology literature on formaldehyde and lymphohematopoietic cancers

Background: The U.S. EPA, through the IRIS Program, is currently drafting a Toxicological Review of formaldehyde. As part of the comprehensive evaluation of potential hazards associated with exposure to formaldehyde, the potential hazards for lymphohematopoietic cancers are being evaluated. We are aware of multiple meta-analyses which have addressed potential associations; however, EPA is conducting an independent review. Aims: To systematically evaluate the epidemiologic literature describing potential associations between formaldehyde exposures and the occurrence of lymphohematopoietic cancers. Methods: We searched three large databases (PubMed, Web of Science and Toxline) for epidemiologic literature on lymphohematopoietic cancers subtypes potentially related to formaldhyde exposure, and reviewed more than 150 studies. EPA prepared figures detailing the literature search process and summarized the relevant evidence in tables and enriched multidimensional forest plots for five specific lymphohematopoietic cancers including Hodgkin lymphoma, non-Hodgkin lymphoma, multiple myeloma, lymphatic leukemia and myeloid leukemia. Results: The final result of the literature search identified more than 25 relevant epidemiologic studies detailing the presence and absence of associations between formaldehyde exposure and the occurrence of lymphohematopoietic cancers subtypes. Forest plots with extensive annotation are used to depict the results graphically. Conclusions: There is a substantial body of epidemiologic literature to address the potential association between formaldehyde exposures and certain subtypes of lymphohematopoietic cancer. Detailed graphical presentation of study results can aid in assessments of consistency by distinguishing between negative and inconclusive results and between random heterogeneity and inconsistency across study results potentially attributable to difference in study designs, populations, and exposure ranges among other factors. Disclaimer: This abstract does not necessarily reflect EPA policy.

Abstract Number	**P-2-09-30**
Presenter	Katherine Bronstein*
Exposure	household air pollution
Health domains	respiratory disease
Type of research	review

The Climate Cookstove Connection: A Review

Background The Global Alliance for Clean Cookstoves notes that the current state of knowledge on the climate-cookstove relationship is inadequate, mostly due to a lack of region-specific emission factors (EF) for greenhouse gases and short-lived climate forcers, such as black carbon (BC). BC is a primary component of particulate matter, which can have severe health effects on exposed populations. A better understanding and quantification of the net climate impact of cookstove emissions is needed to inform policymakers to achieve significant and immediate health and climate benefits in sensitive regions and populations. Aims To summarize (1) climate impacts, (2) how EF vary by region, fuel type, and cookstove technology, (3) the international standards and testing protocols to enhance monitoring and evaluation, and (4) opportunities to reduce cookstove emissions. Methods A systematic literature review was recently conducted on past and current cookstove programs in laboratory- and field-scale settings to summarize emissions testing methods and region-specific cookstove EFs. Data were compiled into a comprehensive database organized by 3 regions (Africa, Asia, Central America/Caribbean, and Latin America). Results EFs are highly variable by fuel type in field settings and the choice of EFs currently used in global inventories (GAINS, SPEW) results in wide-ranging emissions estimates. Using a large number of different criteria, we evaluate the most appropriate EFs to use by region and pick a representative combination of fuel and stove type that can be incorporated into emission inventories to reduce uncertainties in emissions estimates. Conclusions This study presents a new and comprehensive database of cookstove-related EFs for fuel and stove types commonly used in developing countries to better understand the cookstove:climate relationship. This database can be used to improve estimates of national and global emissions that feed into policymaking.

Abstract Number	**P-2-09-31**
Presenter	Vanessa Soppa*, Bryan Hellack, Ulrich Quass, Roel P. F. Schins, Thomas A. J. Kuhlbusch, Barbara Hoffmann
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	randomized trial

UFP from indoor sources and physiological changes – a randomized sham-controlled exposure study of healthy volunteers

Background: PM is known to increase cardiopulmonary morbidity and mortality. Oxidative stress seems to be a common pathway for diverse PM-related health effects. Especially ultrafine particles (UFP) are believed to play a crucial role due to their ability to reach the alveolar space, escape pulmonary clearing mechanisms, and their high surface specific area which enables them to bind toxic substances. While several studies have shown effects of combustion-derived ambient UFP, few have investigated UFP from indoor sources (IS) and their physiological effects on the cardiopulmonary system. Aim: To investigate whether high short-term exposure to UFP from IS elicits local and systemic inflammation, oxidative stress and changes in cardiopulmonary function. Methods: In an ongoing randomized cross-over sham-controlled exposure study, healthy subjects are exposed to 3 exposure scenarios (burning candles (C), toasting bread (T), frying meat (F)) at 2 different exposure levels and to 1 sham exposure with room air (RA) for 2 hours each. Released particles are characterized according to mass-, number- and surface-concentration and oxidative potential. Detailed physical examinations of the subjects (exhaled NO, spirometry, blood pressure, pulse wave analysis, heart rate variability) are performed prior to, during, and 0, 2, 4 and 24 hours after exposure. Venous blood and nasal lavage fluid are analyzed for markers of oxidative stress and inflammation. We calculate changes from pre-exposure values within each exposure scenario and calculate the difference-in-differences. Results: Mean levels of UFP number concentration for C, T, F and RA were 1.841.000/cm3, 879.200/cm3, 317.600/cm3 and 6.393/cm3 respectively. Compared with RA, we could identify subtle changes in cardiovascular function measures in preliminary analyses. Conclusion: We will characterize UFP from different IS and their ability to cause short-term respiratory and cardiovascular biomarker changes in healthy individuals.

Abstract Number	**P-2-09-32**
Presenter	Astrid Schilmann*, Horacio Riojas Rodríguez, Rogelio Pérez-Padilla, Isabelle Romieu, Rosario Fernández Plata, Brenda Carolina Romero Orellana, Víctor M Berrueta
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cohort study

Women´s lung function decline after eight years of an efficient stove intervention

Background. A randomized controlled trial was conducted in the Central Mexican state of Michoacán to evaluate the health impact of the introduction of an efficient biomass stove Patsari in young Mexican women during 2005 and 2006. Actual use of the Patsari stove was associated with a lower FEV1 decline (31 mL) compared to the open fire use (62 mL) over 1 year of follow up. Aims. The aim of this study is to perform a longitudinal assessment of the lung function decline in women after eight years of the introduction of efficient biomass stoves in highland Michoacán, Mexico. Methods. We are performing a longitudinal study on the women cohort established during the previous study in the Purepecha region in the state of Michoacán, Mexico. Biomass smoke exposure is estimated by a questionnaire recalling open fire and stove use since 2005. Following the same standardized procedure as in the previous study, spirometry is conducted using portable battery-operated ultrasonic spirometer in accordance with the ATS/ERS recommendations. The longitudinal FEV1 regression slope is calculated with SPIROLA V3.0 software. The association between lung function decline by reported stove use is analyzed using linear regression models. Results. In a subsample of 37 women from Quinceo, the mean group slope is -19mL/year with an absolute within-person variation of 110 mL. Women mainly using an open fire have an excess lung function decline of -14 mL/year compared to those women mainly using the efficient stove (p=0.104) adjusting for height, FEV1 and age at baseline. Conclusions. This is the first study reporting the longitudinal assessment of the lung function decline (more than seven years of follow up) for women using fuelwood for cooking. These results for a subsample suggest the mid-term positive effect of the intervention.

Abstract Number	**P-2-12-01**
Presenter	Reuy-Lung Hwang*, Chen Chen-Peng, Feng-Yi Lin, Wen-Mei Shih, Kuo-Tsang Huang
Exposure	others
Health domains	no health domain
Type of research	others

Applicability of ASHRAE Standard 55 and EN 15251 Adaptive Thermal Comfort Models in Hot-and-Humid Climate

Background: The inclusion of adaptive thermal comfort model in the ASHRAE Standard 55 and EN 15251 exemplifies the increasing effort of improving indoor environmental quality in naturally ventilated buildings. However the applicability of these models in areas of hot-and-humid climate such as Taiwan has been only insufficiently validated. Aims: This study examined the boundaries of thermal comfort zones as predicted by the ASHRAE and EN models to those established by a field study conducted in Taiwan to examine the discrepancies between these models as well as between the model projection and field observation so to evaluate the models' local applicability. Methods: A field study was conducted to investigate the adaptive thermal comfort in 113 naturally ventilated classrooms of 14 schools in central Taiwan. For a total period of five months consisting of summer, autumn and winter conditions, questionnaire survey were performed to observe the actual thermal sensation of the students in relation to the thermal status in the ambient environment when the school was in session. The observed thermal acceptability was analyzed against those projected by the ASHRAE and EN models using local meteorological data. Results: Both the ASHRAE and EN models significantly underestimated the thermal acceptability of Taiwanese when the ambient temperature fell outside the range of approximately 20 to 30oC. When the upper limit of the comfort zones projected by these models was compared, the predictability of the ASHRAE model appeared to be less than that of the EN model in the warm condition. The EN comfort zones Category I and II were more consistent to field observations than the ASHRAE comfort zones 90 and 80%. Conclusions: When applied to specific regions the ASHRAE and EN adaptive comfort models should be first assessed for applicability and calibrated to accommodate regional differences in climate and in patterns of thermal adaptation.

Abstract Number	**P-2-12-02**
Presenter	Joris van Loenhout*, Amanda le Grand, Gerard Hoek, Frans Duijm, Moniek Zuurbier
Exposure	climate change (temperature)
Health domains	other
Type of research	exposure measurement

Building characteristics are associated with high temperatures in dwellings of elderly people

Background: Studies have shown that high ambient temperatures increase mortality of persons over 65 years of age. Since elderly people spend most of their time indoors, it is important to get more insight in the relation between ambient and indoor temperature of different types of dwellings of elderly residents. Aims: To observe whether there is a relation between building characteristics and the difference between indoor and ambient temperature (T) in dwellings of elderly people during warm weather in the Netherlands. Methods: Indoor and ambient temperature were measured every 30 minutes in the living rooms of 112 dwellings of elderly people in two cities in the Netherlands from May to August 2012. Building characteristics were surveyed using a checklist, including building type and materials, floor level and availability of sun protection and cooling systems. The relationships between indoor-ambient temperature difference and building characteristics were studied using linear regression. Results: Data from the warmest week of 2012 (August 14-20) were used for the analysis (mean ambient T = 23.5 ˚C). The mean indoor temperatures of the dwellings ranged from 22.5 - 30.0 ˚C. The mean difference between indoor and ambient temperature varied from 0.0 - 6.0 ˚C. Two building characteristics contributed significantly to the difference between indoor and ambient temperature: the floor of the living room (0.3 ˚C increase per increase in floor level, p<.001) and the direction of the windows (living rooms where solar radiation was high were 1.0 ˚C warmer than living rooms with low solar radiation, p=.001). Conclusions: Several building characteristics influence temperature of dwellings of elderly people during the summer months. This provides opportunities for constructors to take into account when refurbishing dwellings or building new dwellings for the elderly.

Abstract Number	**P-2-12-03**
Presenter	Tarik Benmarhnia*, Youssef Oulhote, Claire Petit, Séverine Deguen, Denis Zmirou-Navier
Exposure	climate change (temperature)
Health domains	equity
Type of research	time series study

Chronic air pollution and social deprivation as modifiers of the association between high temperature and daily mortality

Background Both heat and air pollution are associated with mortality. However, whether the effect of temperature on mortality is modified by air pollution remains unsettled. Also, chronic exposure to air pollution, as a potential effect modifier, has never been studied in the relationship between heat and mortality as well as the double interaction with social deprivation. Aims The aim of this study is to identify whether the effect of daily temperature on all-cause mortality is modified by chronic exposure to air pollution (NO2 representing urban traffic) and social deprivation, and a combination of these two factors. Methods We used daily mortality data from 2004 to 2009, daily mean, minimum and maximum temperature variables controlling for daily N02 and relative humidity for Paris, France. Estimates of chronic exposure to air pollution and social deprivation were split into three strata. We developed stratified Poisson regression models to assess daily temperature and mortality associations and tested the heterogeneity of the regression coefficients in different strata. Deaths due to ambient temperature were calculated from attributable fractions. Results We found that chronic exposure to air pollution modifies the association between daily temperature and mortality, with 35 (95% CI=[25-44]) deaths attributable to temperature in summer in low polluted areas and 47 (95% CI=[33-61]) in high polluted areas. Thirty (95% CI=[16-45]) deaths are attributable to temperature in summer in low social deprivation areas and 54 (95% CI=[37-71]) deaths in high social deprivation areas. We also found that there is a combined effect modification of social deprivation and chronic exposure to NO2 in the mortality-temperature relationship. Conclusion Our results may have implications in considering chronically polluted areas as vulnerable in heat actions plans and in the long-term measures to reduce the burden of heat stress especially in the context of climate change.

Abstract Number	**P-2-12-04**
Presenter	Mironova Varvara*, Dmitry Orlov
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	others

Climate change trends and their role in re-emergency of vivax malaria in European Russia

Background. In the pre-elimination era malaria was endemic in most of Europe. In the middle of 20th century all species of malaria were eliminated, and vivax malaria was the last to disappear. Since then, short-living episodes of autochthonous transmission following importation of P.vivax have been documented in a number of European countries, but Russia was the most affected. From 1997 to 2010, more than 500 autochthonous cases were recorded in European Russia. Aims. We investigated the variations of favorability of weather conditions in different parts of European Russia in order to assess their role in malaria re-introduction. Methods. Summer temperatures have been analyzed for 9 geographical points of various climatic zones in East European plain for 51 years up to 2010. The analysis was based on Moshkovsky's method. Each summer season was classified upon its favorability to vivax malaria transmission into 4 groups, from "absolutely unfavorable" to "particularly favorable". Results. During this period the favorability of weather conditions increased, which was particularly marked at the latitudes 52-56°N. For instance, in Moscow before 1984 unfavorable seasons predominated and transmission was impossible during 3 summers. After this point transmission was possible every year, and favorable seasons predominated. Weather conditions were particularly favorable in 1972, 1981, 1988, 1989, 1995, 1999, 2002, 2007, 2010. During 5 out of those 9 summers autochthonous transmission actually occurred. Conclusions. Since mid-1980s receptivity to malaria increased due to a more favorable combination of temperatures during summers. Average daily temperatures (ADTs) during the first half of June are the most important. If, as it often happens, ADTs drop below +16°C for a week or so during this period, probability of autochthonous transmission during the rest of summer lessens very considerably. This may be used for a short-term forecast of malaria situation.

Abstract Number	**P-2-12-05**
Presenter	Barbara Schumann*, Joacim Rocklöv
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Climate variability and mortality in pre-industrial Northern Sweden

Background and aims Little is known about how climatic conditions influenced human health before the onset of industrialization. We used historical data to investigate the impact of seasonal temperature and precipitation on total mortality in Skelleftea, Northern Sweden, between 1749 and 1859. Design We retrieved mortality and population numbers of the Skelleftea parish from digitized parish records, and obtained monthly temperature measures from Umea, and precipitation measures from Uppsala. Statistical models were established for year to year variability in deaths by annual and seasonal temperature and precipitation, adjusting for longer time trends. Relative risks (RR) with 95% confidence intervals (CI) were calculated. Results During the observation period, the population in Skelleftea parish increased from ca. 3,600 in 1750 to >16,000 in 1859. Annual mortality decreased considerably over time, but there continued to be high fluctuation with several peaks related to war, famines and cholera outbreaks. We found a statistically significant association between winter temperature and annual deaths (RR 0.97, CI 0.95-0.99, adjusted for winter precipitation), as well as for spring temperature (RR 0.95, CI 0.91-0.98) and summer precipitation (1.01, CI 1.00-1.03, per cm increase of precipitation, adjusted for temperature). In the full model including temperatures and precipitation levels of all four seasons, only autumn precipitation proved significant (RR1.02, CI 1.00-1.03), while winter temperature and spring precipitation approached significance. Similar effects were observed for men and women, but did not always reach statistical significance. Conclusions In this pre-industrial town, milder climate in winter and spring appeared to decrease annual mortality, while high levels of rain during the autumn increased the death toll. Additional analyses will look at age-specific and monthly deaths.

Abstract Number	**P-2-12-06**
Presenter	Yoonhee Kim, Ho Kim*, Hae-Kwan Cheong, Masahiro Hashizume, Yasushi Honda, Jinseob Kim, Clara Tammy Kim, Jin-Hee Eum, Chisato Imai
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	others

Comparative study of the relationship between regional climate factors and local weather in Western Pacific countries

Many studies have reported that climate change affects the local weather. However, there are still considerable uncertainties, since the results depended on the various regional characteristics, time scales, and statistical models. The purpose of this study is to examine how regional climates such as El Niño–Southern oscillation and Indian Ocean Dipole can influence the local weather, and to compare the patterns between some countries in Western Pacific. Monthly data for regional climate and local weather, such as NINO3, DMI (dipole mode index), maximum temperature, and rainfall, were derived from Regional Office of Western Pacific, concerning 21 regions or cities in Mongolia, South Korea, Japan, Papua New Guinea (PNG), Laos, and Cambodia. We defined the four seasons in former three countries, but wet and dry seasons in latter countries. Generalized linear models with interaction between season and other explanatory variables (climate or weather) were used to estimate NINO3 and DMI effects on maximum temperature or rainfall. Also, the moving average lag structures of NINO3 and DMI were applied in the model. The significant NINO3 and DMI effects on rainfall were mostly shown in summer (Mongolia, Korea, and Japan) or all season (Laos and PNG), but the direction varied region to region. With respect to maximum temperature, NINO3 and DMI effects were relatively consistent within the country, but varied on season. For instance, the effects in summer (negative on NINO3, positive on DMI) were in contrast with other seasons in Mongolia, Korea, and Japan, in addition NINO3 effect of PNG was negative in wet season, but positive in dry season. Meanwhile, the lagged effects of NINO3 and DMI on rainfall and temperature were mixed from long and short lags in most countries, whereas only short-term effect was dominant in PNG. Local weather was not only influenced by regional climate factors, but the patterns varied on season, time scale, and locations. These results would be able to support understanding the relationship between weather and health problems.

Abstract Number	**P-2-12-07**
Presenter	Jan Kysely*, Hana Davidkovova, Eva Plavcova, Bohumir Kriz
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	health impact assessment

Comparison of impacts of hot spells on mortality and morbidity for cardiovascular diseases in the Czech Republic, 1994-2009

Background: Excess mortality associated with high ambient temperatures in summer represents one of the main impacts of weather extremes on human society. While increases in cardiovascular disease (CVD) mortality during hot weather have been reported in many European countries, much less is known whether similar patterns are found for CVD morbidity. Aims: To examine the effects of hot spells on CVD morbidity (hospital admissions) and mortality in the Czech Republic over 1994-2009, with focus on differences for ischaemic heart diseases (IHD) and cerebrovascular diseases (CBD). Methods: Daily data on hospital admissions and mortality for CVD were obtained from national hospitalisation and mortality registers. The data were standardised to account for long-term changes and the seasonal and weekly cycles. We defined hot spells as periods of at least two consecutive days with average daily air temperature anomalies above the 95% quantile in summer season (June to August). Significance of relative deviations of mortality and morbidity from the baseline was evaluated by the Monte Carlo method. Results: We found that hot spells are associated with excess mortality for all examined cardiovascular events. The effects on CBD tend to be more lagged compared to IHD. Higher excess mortality in females than males is found mainly for IHD while for CBD the differences are much smaller. In contrast to mortality, heat-related hospital admissions for CVD are mostly insignificant. Conclusions: Excess CVD, IHD and CBD mortality in hot spells was not accompanied by increases in hospital admissions. This suggests that extreme heat causes severe deterioration of cardiovascular health leading to death in a short time, before the victims can reach hospital, rather than to disorders resulting in hospitalizations.

Abstract Number	**P-2-12-08**
Presenter	Qishi Zheng*, Thuan Quoc Thach, Poh-Chin Lai, Patsy YK Chau, Crystal CY Choi, Heiko Jahn, Dietrich Plaß, Alexander Krämer, Lutz Katzschner, Chit-Ming Wong
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure measurement

Developing Physiological Equivalent Temperature and assessing hot and cold spots for small geographical areas in a subtropical city Hong Kong

Background: Physiological equivalent temperature (PET), a thermophysiological indicator, has been developed to quantify thermal stress from the environment. However, studies focusing on spatial correlation of small areas within cities are limited. Aims: To construct PET in small geographical areas with a view to quantifying extreme thermal environments in Hong Kong. Methods: We constructed the PET from the Hong Kong Urban Climate Map (UCMap), which was created by the Planning Department in 2006 containingeight classes of thermal conditions at 100m×100m resolution (referred as grid hereafter). First, based on eight PET values computed from the thermal conditions including meteorological variables for each class,we assigned a PET value for each grid associated with a particular class. Second, we averaged the PET values of all the grids within each Tertiary Planning Unit (TPU), which is the smallest geographical demarcation for urban planning, to obtain the typical PET for all TPUof Hong Kong. We then calculated univariate Moran's I and performed Local Indicators of Spatial Association (LISA) analysis to detect global and local spatial variations of PET, respectively. Results: The PET in 145 TPU ranged from 26.3 °C to 31.3 °C. Univariate Moran's I was 0.6118, indicating positive autocorrelation of thermal conditions among adjacent TPU. The LISA analysis identified 39 hot spots (i.e. TPU with high PET are surrounded by TPU with high PET), 62 cold spots (i.e. TPU with low PET are surrounded by TPU with low PET), and 44 unclassified areas (i.e. TPU with high PET are surrounded by TPU with low PET or vice versa). The hot spots were mostly located in TPU with high population density where vehicular traffic flow and building density are high, and green areas are sparse. Cold spots were found in TPU of sub-urban areas where open spaces are prevalent. Conclusions: PET is a useful indicator for thermal environment, and can be used to identify hot and cold spotswithin the city.

Abstract Number	**P-2-12-09**
Presenter	Ho Kim*
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	health impact assessment

Does cold spell make problem these days when global warming is on the progress?

Global warming is raising the average temperature in Korea throughout the country and all the seasons and the rate of increase is particularly high in the winter as reported by many previous studies. Nevertheless, people feel that the intensity of extreme cold in the winter is getting more severe year by year, and mass media are reporting record-breaking cold spells. Thus, this study purposed to examine whether the number of extremely cold days is actually increasing despite the rise of the average temperature and whether the number of deaths increase during the days of cold spell as suggested by these experiences.For this study, we used a total of 18 years' data on weather and death toll during the winter season. Time series analysis was applied to changes in the lowest winter temperature in 6 large cities. The 3rdpercentile data were defined cold spell.To identify the changes of the effects of cold spell yearly, we grouped the years from 92 to 2009 by 10 years and made 9 sets by excluding a previous year and then including the next year by phase. We compared effects of those 9 sets. The relationship between cold days and mortality was estimated using a quasipoisson generalized linear model. Consequently, we calculate relative risk(RR).According to the analysis result, there were increased effects of cold effects in 4 cities including Seoul and there was decrease in 2 cities.This result may be related with the adaptation according to geographical location and the status of housing or heating which is directly related with coldness because those cities were developed in different times. For the accurate interpretation, we need to consider the social and economic level and the level of urbanization of the cities. The important things is that there are increased effects of cold spell on human health year by year although winter temperature becomes higher according to global warming phenomenon. Therefore, it is needed to perform in-depth study on cold spell as well as heat wave.

Abstract Number	**P-2-12-10**
Presenter	Yasushi Honda*, Masahide Kondo, Emiko Minakuchi, Momoko Kayaba, Koichi Nakazawa, Kazutoshi Sugimoto, Yoonhee Kim, Ho Kim, Yue Leon Guo, Masahiro Hashizume
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Effect of absolute humidity on heat-mortality relation in Japan

Background: Previously, we evaluated the confounding effect of relative humidity on temperature-mortality relation in Japan using 1972-1995 dataset, and concluded that humidity did not confound the relation. Since then, we accumulated the data up to 2010. Another finding was that absolute humidity was better variable than relative humidity in evaluating the humidity effect on influenza incidence. Aims: To show the absolute humidity effect on heat-mortality relation using the extended dataset. Methods: We used daily deaths of 65+ years of age and controlled the year trend by setting each year's minimum level mortality to be the reference. As the main weather variable, we used daily maximum temperature. Using distributed lag non-linear model, we set the lag effect of daily maximum temperature up to 15 days. In conducting regression analyses, we used two models, i.e., without and with absolute humidity term along with daily maximum temperature-lag crossbasis. The temperature-mortality relation shows V-shaped pattern, and we used only "heat" part of the temperature range and calculated the excess mortality ratio, i.e.,"without" to "with." Results: The without/with ratio was between 0.90 to 1.10. In this regard, the effect of absolute humidity was not large. However, the ratio tended to exceed one in northern part and southern areas tended to have lower than unity ratios. Conclusions: The absolute humidity effect on heat-mortality relation appeared to be related to climate. If this is generalizable, we need to incorporate humidity variable in the model for future projection of heat-related excess mortality. Acknowledgements: This study was supported by the Environment Research and Technology Development Fund (S-8 & S10) of the Ministry of the Environment, Japan, and the Global Research Laboratory (grant K21004000001-10A0500-00710) through the National Research Foundation of Korea (NRF), funded by the Ministry of Education, Science and Technology, Korea.

Abstract Number	**P-2-12-11**
Presenter	Ivy Shiue*, Stefan Muthers
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	cross-sectional study

Effect of weather as biometeorologic on hospital admissions in the UK: biometeorological methods comparison

Background Environmental factors are thought to have a role in seasonal variation for many human diseases. Aim In this study, we aimed to study the relationship of weather as biometeorologic and hospital admissions due to different causes in the UK. Method Daily hospital admissions from included primary care trusts (PCTs) within Plymouth area between 1 January and 31 December, 2010 were extracted. We identified asthma admissions (J45-J46), all respiratory disease admissions (J00-J99), circulatory disease admissions (I00-I99), cerebrovascular disease admissions (I60-I69), nervous system disorder admissions (G00-G99), and mental and behavior disorder admissions (F00-F99) as the study outcomes. Hourly weather data including air temperature, humidity, wind speed, cloud cover, and radiation flux in the same time period were obtained and generated into universal thermal climate index (UTCI) and physiological equivalent temperature (PET). Analyses included generalised linear modelling. Results In the present study, we have observed that there were differences among air temperature, UTCI, and PET. However, it's consistent that among the three, weather has significanly impacted on hospital admissions due to ischemia heart disease (temperature: Beta -0.03, 95%CI -0.05 to -0.01; UTCI: Beta -0.05, 95%CI -0.07 to -0.02; PET: Beta -0.04, 95%CI -0.06 to -0.01), hypertension (temperature: Beta -0.12, 95%CI -0.17 to -0.08; UTCI: Beta -0.17, 95%CI -0.24 to -0.11; PET: Beta -0.16, 95%CI -0.21 to -0.10), total mental disorders (temperature: Beta 0.18, 95%CI 0.07-0.28; UTCI: Beta 0.22, 95%CI 0.07-0.36; PET: Beta 0.20, 95%CI 0.07-0.33), and total respiratory disorders (temperature: Beta -0.13, 95%CI -0.15 to -0.11; UTCI: Beta -0.17, 95%CI -0.20 to -0.14; PET: Beta -0.16, 95%CI -0.18 to -0.13). Conclusion Weather could have a great impact than previously thought. PET seems to be more conservative than UTCI as an exposure in assessing effect of weather on hospital admissions.

Abstract Number	**P-2-12-12**
Presenter	Davaa Gombojav*, Burmaa Horoljav, Darmaa Munhdorj
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

EPIDEMIOLOGICAL CHARACTERISTIC OF DISTRIBUTION FOR ANIMAL AND HUMAN ANTHRAX

Background: Emerging vector-borne diseases are an important issue in Mongolia. In the recent years, the number of anthrax on human is increased and the border of the natural foci has been extended to the Gobi region, particularly in the Gobi-Altai, Dundgobi Aimags. Outbreak has been happening in Selenge aimag. Aim of study: To determine the current situation and trends of anthrax and geographical distribution, characteristics and risk factors for transmission. Methods: Officially the anthrax first case was registered in 1964 in Mongolia. Long term dynamics of anthrax which was registered between 1964 and 2012 were analyzed by regression analysis. Mean of monthly dynamics was analyzed by NCSS program and seasonal variations were determined and future trends for 2013-2018 was projected through Arima model. Since then till 2012, total of 291 cases were registered and it is shown in retrospective descriptive research design. Results: Mongolia covers 1 565 000 square kilometers area and is divided into 20 regions which turns into 330 provinces, 1561 bags. It has mostly carbonated and non carbonated dark brown soil. High mountainous area has forest steppe and steppe region black and brown soil. Southern part and Gobi region have arid steppe grey and brown is mainly dominated and salty and sandy soil is spread sparingly. Livestock anthrax is spread in 110 soums of 18 aimags which is 30.5 % of total land and human anthrax is spread in 100 soums of 18 aimags which covers 33.3 % of total land area. Anthrax agent is spread 86 soums of 17 aimags which counts 28.6 % of total land area. By quarterly index of anthrax, peak season starts in June and carried from July to October where we can conclude that livestock and human anthrax in Mongolia is seasonal. Conclusions:689,100 km2 which 44,5 % of the total land of Mongolia has anthrax natural foci. Anthrax human and livestock cases dynamic were indexed by the international standard and it can be concluded that anthrax in Mongolia is seasonal.

Abstract Number	**P-2-12-13**
Presenter	Crystal Romeo*, Amir Sapkota
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	case-control study

Exposure to an Aggregate Climate Change Metric and Respiratory Health Outcomes in the Continental US

Background: Climate Change is an emerging public health issue. Studies have examined how change may affect acute hospitalizations, mortality, and infectious diseases, but its potential impacts on chronic diseases, such as asthma, are poorly understood. Aims: We explored the association between exposures to increased frequency of unusually hot days and the risk of asthma exacerbation (asthma attack and hospitalization for asthma) and hay fever using nationally representative sample of US population from the National Health Interview Survey (NHIS 2008-2010). Methods: We computed county level exposure metrics to identify counties with high numbers of unusually hot days in a given year relative to a baseline period (1960-1980). “Exceedence days” were defined as the number of days within a given month that exceeded the 95th percentile of the distribution of the maximum temperature for a baseline period for the county. E95 and E99 for NHIS respondents were defined by summing the county-specific monthly counts for 1 year prior to quarter of interview. We used logistic regression to obtain odds ratios (OR) and 95% confidence intervals (CI) for the association between these metrics and asthma exacerbation (asthmatics only) and hay fever (adults). Results: Asthmatics living in counties with high numbers of hot days using E95 had increased risks of hospitalization (OR 3.26, CI: 1.90-5.57). No associations with asthma attacks were found. Among all adults, those living in counties with high numbers of hot days had higher risks of hay fever using both E99 (OR: 11.09, CI: 1.01- 1.19) and E95 (OR: 1.28, CI: 1.12-1.48). Conclusion: Preliminary results suggest that exposure to excessive heat may be associated with increased risk of asthma hospitalization among asthmatics and hay fever among adults. Further analysis is being conducted to explore how these associations across sub-population and geographical area

Abstract Number	**P-2-12-14**
Presenter	Kayo Ueda, Chris Fook Sheng Ng*, Daisuke Goto, Toshinori Ariga, Keisuke Matsuhashi, Akinori Takami
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Future Mortality due to extreme heat in an aging population of Japan

Background Population aging is anticipated to have great influence on the future estimation of heat-related illnesses since the proportion of elderly susceptible to heat will expand. In assessing the health impact of climate change, very few studies had looked into the uncertainty arising from such demographic change. Aims In this study, we estimated the number of deaths attributed to heat in the Kanto region of Japan under different population growth assumptions. Methods Daily weather data for August of current (2004) and future period (2030) were derived from the Nonhydrostatic Icosahedral Atmospheric Model (NICAM). Extreme heat was defined by the 95th percentile of annual daily mean temperature for the Kanto region covering Saitama, Chiba, Tokyo, and Kanagawa. The following population forecast scenarios for 2030 were assumed: (A) population and age distribution remained constant as in 2005; (B) population projection with similar age distribution as 2005; (C) population projection with aging. The number of deaths due to heat for the 65 year-old and above was estimated for daily temperature changes above the percentile cut-off in each population grid of about 1x1 kilometer. Results When aging was factored in the 2030 population forecast, the estimated proportion of heat-related deaths among the elderly aged 65 years and over tripled from 0.6 to 1.8% of non-injury deaths for August 2004 and 2030 respectively. Assuming no adaptation, estimated crude number of deaths due to extreme heat under aging scenario C were 629 compared to the estimates under naïve scenario A and B of 232 and 212, respectively for August 2030. Conclusions While aging varies by country, the future health impact of weather can be underestimated without taking into account the increasing vulnerability of population due to aging.

Abstract Number	**P-2-12-15**
Presenter	Gulrez Shah Azhar*, Amrutasri Nori-Sarma, Dileep Mavalankar, Ajit Rajiva, Jeremy Hess, Kim Knowlton, Perry Sheffield
Exposure	climate change (temperature)
Health domains	other
Type of research	cross-sectional study

Heat related deaths in India: An insidious environmental threat

Background: Higher than average temperatures, as well as more frequent and severe extreme heat events, can lead to a higher risk of morbidity and mortality. Little is known about the relationship between temperature and mortality in developing countries, including India. Aims: In this paper, the authors describe the general relationship between temperature and mortality as well as the specific correlation between temperature and mortality during the extreme heat wave in May 2010 in the city of Ahmedabad, Gujarat state, India. Methods: This study was conducted using direct correlation of temperature and mortality, as well as a 7-day averaged mortality analysis. Temperature data was obtained from the Indian Meteorological Department; daily gross mortality data from 2005 until 2012 was obtained from the Ahmedabad Municipal Corporation. Results: The results indicate an approximately 30% increase in mortality during the 2010 heat wave period as compared with the average deaths in the same time frame of other years. Potential confounders of the relationship may include infectious disease outbreaks, air pollution, and individual-level characteristics such as smoking. Conclusions: The model developed in this paper may be useful in application to other similar climatic environments in India, and the analysis presented may be implemented into future Heat Health Early Warning Systems.

Abstract Number	**P-2-12-16**
Presenter	Martin-Immanuel Bittner*, Matthias Nuebling, Ulrich Stoessel
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Heatwave-associated excess mortality in Freiburg and Rostock in 2003 and 2005 – methods and results

Background: Heatwaves pose a severe threat to the health of populations. Due to climate change, an increase in frequency and intensity of heatwaves is to be expected. The importance of the quantification of heatwave-associated excess mortality is also due to the potential implementation of preventive measures, which can save lives. Despite of the relevance of this topic for public health practice, there are only few studies from Germany examining the effects of heatwaves on mortality. The studies conducted so far mostly concentrated on bigger cities or Federal States. Aims: Our study aimed at assessing heatwave-associated excess mortality in two medium-sized cities (200,000 inhabitants) in different areas of Germany: Freiburg in the Federal State of Baden-Wuerttemberg, situated in the Rhine valley with a relatively warm general climate, and Rostock in the Federal State of Mecklenburg-Vorpommern, situated in Northern Germany on the Baltic Sea. Methods: The mortality and climate data of Freiburg and Rostock for 2003 and 2005 were obtained and heatwaves (based on the Kysely criteria) were compared to control periods following Hoshiko's approach. An analysis of variance (ANOVA) with mortality as the dependent parameter and heatwave as the predictor was used for the assessment of the significance in these differences. Results: In Freiburg, a long lasting heatwave in 2003 cost 21 lives (equal to a significant excess mortality of 33%). Taken together, the three heatwaves identified in Freiburg in 2003 cost 26 lives (equal to a significant excess mortality of 26%). No or no significant heatwave-associated excess mortality was found for the heatwaves in Freiburg in 2005 and for Rostock in 2003 or 2005. The introduction of lags did not change the findings significantly. Conclusions: The detection of heat-related mortality depends on the size of the cities and the heatwave characteristics (in a specific climatic setting), resulting in a deviation from expected daily mortality potentially to be detected.

Abstract Number	**P-2-12-17**
Presenter	Stephen Browne*, Ariana Zeka, Patrick G. Goodman, Helen McAvoy
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	case-crossover study

Increased mortality from extended cold weather, Ireland 1984-2007

Background and aims: Cold weather is shown to impact mortality and morbidity, with effects persisting from several days to weeks. This study aimed to assess prolonged effects of cold temperature on mortality in Ireland, and to assess for effect modification of the cold weather-mortality relationship by age and gender. Methods: A time-stratified case-crossover approach was used to examine cold weather effects on daily mortality (1st January 1984-31st December 2007). Risk of mortality was examined in association with exposure to daily maximum temperatures on the same day of the event (lag0) and up to 6 weeks (lag42) prior the event. Mean weekly lags (for lags1-7 up to lags36-42) were included in a distributed lag model. Models tested the effects of exposure during the cold season and winter months, and were stratified by age and gender to assess for effect modification. Results show per cent (%) change in mortality for every 1oC decrease in daily maximum temperature. Results: Increases for all-cause (ALLM) and cardiovascular (CVD) mortality were seen for exposure in week 1, weakening, but extending up to 4 weeks prior to death. Respiratory disease (RD) mortality increases were strongest for exposure in week 2 to 4, extending into week 5. Stroke mortality was elevated for exposure in week 1, with some effect up to week 3. During the cold season, the cumulative effect of temperature over the five week period prior death increased by 3.7% (95%CI: 3.0%-4.3%) for ALLM, 3.8% (95%CI:2.6%-4.9%) for CVD, 3.5% (95%CI:1.4%-5.6%) for stroke, and 7.5% (95%CI:5.9%-9.1%) for RD mortality. The effects in winter were stronger than those shown in the cold season, but with similar patterns. We found no difference in effects by age and gender. Conclusion:This study found a strong association between exposure to cold temperatures and all-cause and cause-specific mortality in Ireland. The effects of cold weather on mortality persisted up to 35 days prior to death. These findings have implication on public health policy and preventing early mortality from cold weather.

Abstract Number	**P-2-12-18**
Presenter	Chao-Yu Guo*, Mu-Jean Chen, Chen-Wei Tsai, Huey-Jen Su
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Monthly Stratified Analysis Captures Various Impact of Temperature on Mortality

In general, either the adjustment for the seasonal effect or stratifications by the four seasons was implemented when examining the association between temperature and mortality. However, through systemic statistical tests and examinations by the six major cities in Taiwan from 1994-2008, we discovered that such strategies may not remove the seasonal effect that modifies the association between temperature and mortality, and hence potentially lead to a biased conclusion. Therefore, we conducted the monthly stratified analysis and discovered various impacts of temperature measures on mortality in different populations. In the elderly population, the daily range of temperature posts the most significant impact on mortality in spring and fall seasons, while the mean, minimum and maximum temperature measures are strongly associated with mortality in the winter and summer seasons. In contrast, the younger population is affected by most temperature measures only in the hot months, except the daily range in the spring. Results of the total population showed mixed information from the elderly and younger populations. In summary, monthly stratified analysis could better reduce the interaction between the seasonal effect and temperature, avoid erroneous estimates, and capture the fine patterns of association between temperature measures and mortality through the year.

Abstract Number	**P-2-12-19**
Presenter	Virpi Kollanus*, Timo Lanki
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Mortality effects of prolonged heat waves in Finland

Environmental heat is a health risk especially for the elderly and those with a pre-existing disease which may affect one's ability to take cover from heat exposure or to physiologically cope with heat stress. Mortality effects of prolonged heat waves in 2003 (21 days) and 2010 (27 days) in Finland (excluding northern regions of the country) were studied by comparing mortality in heat wave days with daily mortality at the same time period in other years in the 2000s using Poisson regression. As a sensitivity analysis, comparison of daily mortality was also made in regard to similar length periods before and after the heat waves. Effects were estimated for different age groups, genders, causes of death, and places of death. During the heat waves, natural mortality increased 14-21% in people aged 75 or above. Risk of death grew significantly for diseases of the circulatory system, respiratory system, and nervous system, and mental and behavioural disorders. Increase in mortality risk was higher in health care facilities than other places of death. Overall, 220 (95% confidence limit: 169-268) and 309 (237-375) deaths were attributable to the heat wave in 2003 and 2010, respectively. In conclusion, prolonged heat waves can cause significant public health impacts in Finland. People most at risk are those aged over 75 and suffering from various types of chronic diseases. In the future, more efficient mitigation of adverse effects of heat is needed as population ages and climate change proceeds. Special attention should be given to the conditions in health care facilities.

Abstract Number	**P-2-12-20**
Presenter	Youn-Hee Lim, Yasushi Honda, Yue-Liang Guo, Bing-Yu Chen, Yun Chul Hong*, Seung-Muk Yi, Ho Kim, Na-Kyung Kim
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	time series study

Population adaptation to heat waves and cold spells in East Asia

Background: Quantitative analysis of temperature variability greatly relies on the short-term effects of heat waves or cold spells. However, these time-series analyses are insufficient for the provision of evidence of human adaption to temperature variability. Aims: We examined mortality changes associated with the frequency of extreme conditions. Methods: We analyzed all-cause mortality associated with frequency of heat wave and cold spell in 15 Asian cities in three nations (Korea, Japan, and Taiwan). Heat waves and cold spells were determined in the top and bottom 5th percentile of temperature, respectively, and only those conditions which persisted for at least 2 days were included as extreme weather events. The corresponding mortality proportion and percentage of years with extreme weather events were analyzed using linear regression. Results: The relationship between extreme weather events and mortality differed by temperature range of the city location. Cities with less frequent heat waves showed a greater relative mortality from heat waves than cities with more frequent heat-waves. However, frequent cold spells showed similar risk for populations residing in areas of lower winter temperatures regardless of cold spell frequencies. Conclusion: This study found that populations respond differently to abnormal weather conditions depending on the temperature range (hot or cold).

Abstract Number	**P-2-12-21**
Presenter	Nai-Yun Hsu*, Yen-Hsu Lin, Wen-Chi Pan, Chao-Yu Guo, Huey-Jen Su
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure modeling

Predictive model of indoor temperature from ambient levels

Atmospheric temperature has been found to increase significantly as the consequence of global warming. Ecological studies have evidenced that changing of ambient temperature, collected from atmospheric monitoring station, is associated with adverse health effects. Yet, whether outdoor temperature could be viewed as a representative exposure level is in dispute since people stay mostly indoors. This study aims to estimate the relationship between atmospheric and indoor temperature in typical residences, and further to establish the predict model for indoor temperature based on outdoor information collected from ambient monitoring station. Twenty-six homes selected from 10 major cities throughout the entire island were recruited in Taiwan. Real-time monitors for indoor temperature were set inside the rooms where occupants spent most of their time in the house, and ambient information from nearby station was collected accordingly. Mixed model was conducted for data analysis afterwards. From August 2012 (summer) to January 2013 (winter), average temperature inside 26 homes is 24.8°C (range: 14.0-33.0°C) while outdoors is 22.6°C (range: 8.0-34.3°C). Correlation coefficients between hourly indoor and outdoor temperatures appear to vary by month (0.30-0.64) and city (0.56-0.82). Overall, outdoor temperature, combines with cities and months of the year, explains 27.2% of the variance (R2) for the in-time indoor temperature. Four-hour lag of outdoor temperature is found to be with the highest estimation and R2 (34.6%) compared to the 2-hour, 8-hour and 24-hour lag ones. The R2 rises to 35.2% when considering the other significant factors including sunshine hours, building age, material types (RC, SRC or brick) and surrounding environment (near normal trafficor calm street), which is the best model according to the AIC value. Preliminary results show that ambient temperature with limit ability to predict the indoor temperature in Taiwan. More determinants should be identified and included to establish a more reliable predictive model in future work.

Abstract Number	**P-2-12-22**
Presenter	Ankie Sterk*, Ton de Nijs, Ana Maria de Roda Husman, Jack Schijven
Exposure	water
Health domains	infectious diseases
Type of research	exposure modeling

Quantifying climate change impacts on runoff of zoonotic pathogens from land

Background and aims Several studies have shown a correlation between rainfall and waterborne disease outbreaks. One of the mechanisms whereby rainfall may cause outbreaks is an increase in runoff of animal faeces from fields to surface waters. Faeces originating from wildlife, domestic animals or manure-fertilized fields, is considered an important source of zoonotic pathogens to which people may be exposed by water recreation or drinking-water consumption. Climate change affects runoff because of increasing winter precipitation and more extreme precipitation events, as well as changes in evaporation. The aim of this research is to quantitatively analyse the impacts of climate change on pathogen runoff. It is important to be able to estimate such impacts in order to enable targeted implementation of effective intervention measures Methods and results A quantitative model using Mathematica software will be developed to estimate concentrations of pathogens originating from overland flow during runoff events. Different input sources will be included by applying different land-use scenarios, including point source faecal pollution from dairy cows and geese and diffuse source pollution by fertilization. Zoonotic pathogens, i.e.Cryptosporidium and Campylobacter, were selected based on transport properties, faecal loads and disease burden. Transport and survival rates of these pathogens are determined considering effects of changes in climate, changes in soil or vegetation and adjustments in agricultural policy. The outputs of this model can be used to assess how expected climate change could affect pathogen concentrations in surface waters. Conclusions The results of the model will be included in the larger framework of the “Climate Cascades Project”, and can be used to quantify the impact of climate change on the infection and eventual disease risks due to exposure to water transmitted pathogens.

Abstract Number	**P-2-12-23**
Presenter	Alejandro Molina-Garcia*, Josefina Martinez-Ponce, Gloria Alicia Figuero-Aguilar, Ramiro Yañez-Gonzalez, Raymundo Puebla-Calderon, Rafael Diaz-Rodriguez, Gerardo Mendoza-Ramirez, Jose Alfonso Cervantes-Gutierrez
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	health impact assessment

Recognition of Infectious Diseases like Health Effects of Climate Change in Michoacan, Mexico during 2009-2011.

Background: Exist indirect pathways from climate change to alter transmission dynamics of disease vectors (e.g. triatominae and mosquitoe) and vector-borne diseases (e.g. chagas disease and dengue). Also, food and water borne diseases. A direct pathway to acquire infectious disease is the altered air chemistry with high air pollutants concentrations like ozone and other human airways irritants. Aims: Obtain epidemiological evidence related with climate change locally in the last three years. Methods: An ecological design trying to obtain epidemiological evidence to suggest hypothesis about climate change phenomena and how is reshaping the distribution of infectious diseases across local scale. We obtained epidemiological surveillance data from laboratory and local disease register called SUIVE in 2009-2011. Also, meteorological conditions like temperature and precipitations were obtained from a state meteorological stations proportioned by the National Water Comission. Results: We found 258 positive cases of Chagas disease during 2009-2011, some of them in places where were not reported in the past like Maravatio region (4 cases). 3 cases of coccidiomycosis were investigated in the state laboratory in Buenavista region in 2011. An outbreak of vibrio parahaemolyticus related with sea foodborne was registered in april 2010. And, finally, a set of acute diarrhoeal, respiratory, dermal, conjunctivitis and parasitic infections were reported after flooding on february 2010 in Angangueo region. Temperature on april 1950-2000 was in range 15ºC to 30ºC. Rain was 3mm- 32mm in the same period. Temperature and rains scenarios, MPIECHAM 5, A2, on april 2030 and 2050 were 18ºC to 31ºC and 19ºC to 33ºC, respectively. Precipitation was 4mm-12mm and 2mm-16mm, respectively. Conclusions: This is among the beginning of empirical evidence of epidemics diseases with epidemiological studies that anthropogenic climate change is driving the emergence of infectious diseases in Michoacan state of Mexico.

Abstract Number	**P-2-12-24**
Presenter	Sari Kovats*, Anita Ramesh, Clare Gilbert, Elena Schmidt, Dom Haslam
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	review

Systematic review of the effects of climate factors on the prevalence and distribution of acute and chronic trachoma

Background: Trachoma is the world's leading cause of preventable blindness and is considered a neglected tropical disease. The primary causes of trachoma relate to poverty, but environmental factors (fly density, access to water and sanitation) are important and a key part of the SAFE intervention strategy. Trachoma prevalence is thought be associated with dry climates and exposure to dust. Aims: To investigate the evidence base for the direct impacts of current climate factors on trachoma prevalence and distribution. Methods: Systematic review of epidemiological studies that have quantified an association between meteorological observations or climate parameters and trachoma. The outcomes included were acute trachoma (to identify factors associated with transmission) and cicatricial/ blinding trachoma (to identify factors associated with scarring). Results: Eight papers met our strict criteria. Several papers reported an association between trachoma prevalence and altitude in African populations. Although most studies found that trachoma incidence declined at higher altitudes (providing some evidence of a role for temperature in transmission), some studies found the opposite effect. A robust mapping study found strong evidence of an association between low rainfall and active trachoma. There is also consistent but weak evidence that the prevalence of trachoma is higher in savannah-type ecological zones. No information was found on the effect of climate factors in low endemic areas or on the effect of dust on trachoma. Conclusions: Current evidence on the potential role of climate on trachoma is limited despite a wealth of anecdotal evidence. Temperature and rainfall factors appear to play a role in the transmission of active trachoma. However, the mechanisms are unclear and likely to be complex, particularly regarding the role of other environmental factors (such as flies), and behaviour in arid and semi-arid areas. Most studies did not adequately control for socioeconomic or environmental confounders.

Abstract Number	**P-2-12-25**
Presenter	Arturo Curiel Ballesteros*, María Guadalupe Garibay-Chávez
Exposure	climate change (temperature)
Health domains	other
Type of research	exposure measurement

Temperature increase and mortal falls

Background. Human beings have a Thermoneutral Zone, in which they exist in a state of wellbeing. With respect to human beings, this zone ranges from 24 to 31oC. When they are exposed to higher temperatures, there is a risk of suffering indirect psychological impacts which may give rise to reactions and emotions associated to anxiety, worry, desperation, pain, distress, disinterest, or insensitivity (Doherty and Clayton, 2011); all of the foregoing factors could lead to accidents such as falls (W19.9). Aims.To estimate the probability of mortal accidents due to falls as related to an increase in ambient temperature. Methods. Information relating to the metropolitan area of Guadalajara, Mexico, was analyzed in order to identify recent atypical years with respect to high temperatures, finding that the year 2005 was such an atypical year. Mortality rates for 2005 were reviewed, identifying the number of people who had died due to accidental falls. The distribution of such deaths throughout the year was analyzed in order to detect whether, on days with temperatures above 31oC, the probability of occurrence of such accidents increased. Results. On 66 days during 2005, the residents of Guadalajara's metropolitan area were exposed to temperatures above 31oC. The probability of death due to accidental falls during high temperatures was 10%, while on days when the temperature was below 31oC, the probability was 3%. The high-temperature period during which most deaths occurred was from May 18 to June 8, when the rainy season had not yet begun.The average age of the people who died during the high-temperature period was 62 years; 50% men and 50% women. The average age of the people who died other than during the high-temperature period was 65 years; 90% men and 10% women. Conclusions.These results point to the convenience of further evaluating how an increase in temperature (other than during the rainy season), augments the risk of mortal falls associated to psychological impacts and their relation to accidents, especially in view of climate change factors.

Abstract Number	**P-2-12-26**
Presenter	Antonio Gasparrini, Ester Rita Alessandrini*, Stefano Zauli Sajani
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	time series study

The association between high temperature and emergency ambulance dispatches: a multi-city analysis

Background: while the effects of temperature have been extensively evaluated for mortality and hospital admissions, the association with other outcomes has received less attention. Aims: to investigate the relationship between summer temperature and emergency ambulance dispatches in a multi-city study from Italy, using novel statistical approaches. Methods: Time series data for the period 2002-2006 (May-Sept) were collected in the major 9 cities of the Emilia-Romagna region for people aged 35+ (168,180 emergency calls in total). A two-stage time series analysis is performed, with city-specific models including bi-dimensional splines of apparent temperature with a distributed lag non-linear parameterization on lag 0-15. Estimates are reduced to summaries of overall cumulative and predictor-specific effects, which are then pooled using a multivariate random-effect meta-analysis fitted through restricted maximum likelihood. Results: apparent temperature ranges homogeneously across cities between 10°C and 34°C. The exposure-response relationship is flat for mild summer temperature, with an evident non-linear increase above 27°C. The relative risk for 32°C versus 23°C, corresponding approximately to the 99th and 50th temperature percentile, is 1.14 (95%CI: 1.11-1.19) at lag 0 and 1.52 (1.36-1.71) when cumulated across all lags. The analysis of the lag structure suggests that the effect of high temperature lasts 11-12 days, with no evidence of short-term harvesting. Discussion: this analysis emphasises the strong association between high temperature and emergency ambulance dispatches, highlighting how the health effects are not limited to the increase in mortality and hospital admissions. The novel analytical approach adopted here includes city-specific and meta-analytical models which allow a flexible estimation of non-linear and lagged exposure-responses. This effect indicator may be useful for defining real-time surveillance systems.

Abstract Number	**P-2-12-27**
Presenter	Ilsang Ohn, Young-Eun Yi, Youn-Hee Lim, Yasushi Honda, Yue-Liang Guo, Bing-Yu Chen, Ho Kim*
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

The effect of temperature change on mortality in 3 East Asian cities

Background: The relationship between temperature and mortality has been demonstrated around the world. This relationship usually tends to be U-shaped pattern, likely to be highly risky at cold and hot temperature. We are further interested in the effect of temperature change on mortality. Some studies already addressed this topic, yet these studies are limited due to its methodological limits. Aims: This study aims to estimate the effect of temperature change in Seoul, Tokyo and Taipei, using the proposed methodology. Methods: We used daily non-accidental death counts and meteorological data in 3 cities. We defined temperature change (TC) as the slope of the simple linear regression line of daily mean temperature during specific TC period. We set TC periods as 7, 30 and 90 days. We designed the Generalized Additive Model (GAM) that includes temperature as natural cubic spline function, negative TC and positive TC as linear term. The model also includes some confounding factors such as daily mean humidity, mean PM10, time trends and day of the week (DOW). The expected number of deaths is assumed to follow the Poisson distribution. We defined increased (decreased) TC effect as the percentage change of mortality when TC increases (decreases) 1℃/day at positive (negative) TC. Results: The increased TC effect during 7 days is significantly positive in all 3 cities. The increased TC effect during 30 days is significantly negative in Tokyo and Taipei, but not significant in Seoul, and the effect during 90 days is significantly negative in all 3 cities. The decreased TC effect during 7 days is significantly negative in Taipei only, but not the case in other cities. The decreased TC effect during 30 days or 90 days remains significantly positive in all 3 cities. Conclusions: Temperature increase has harmful effect at short-term, yet adaptation effect at long-term. Meanwhile, temperature decrease has less effect for short-term exposure, but harmful effect for long-term exposure.

Abstract Number	**P-2-12-28**
Presenter	Wonwoong Na, Sun Hee Kim, Kyungeun Lee, Hyung-Nam Myung, Soo-nam Jo*, Jae-Yeon Jang
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	others

The Effects of meteorological disasters on the incidence of waterborne and foodborne diseases in Republic of Korea, 2001-2009

background There is a need to quantitatively assess the kinds and damage amounts of infectious diseases increasing after a meteorological disaster and identify the subjects of focused monitoring in order to reduce the negative influences of meteorological disaster on health. aims This study set out to assess effects of all meteorological disasters in Korea from 2001 to 2009 on the waterborne and foodborne diseases. methods The study analyzed all case of floods and typhoons on the Annual Report on Disasters by National Emergency Management Agency in Korea from 2001 to 2009. We compared the pattern of weekly incidence of Vibrio vulnificus septicemia (VVS), shigellosis, typhoid and paratyphoid fever before and after disasters by Poisson regression model. The interaction effects of general characteristics of disaster on relative risk of each disease were analyzed, too. results The number of all case of disasters by administrative unit was 312. Relative risk of incidence of VVS and shigellosis to incidence before disasters was peak at 2.49(95% CI 1.47-4.22) and 3.10(95% CI 1.21~7.92) in second week after disaster, respectively, and continued to drop after that. There is no significant increased risk of typhoid and paratyphoid fever during 4 weeks after disaster. The pattern of incidence of VVS can be changed by type of disaster or average precipitation and that of shigellosis can be influenced by average precipitation only. Conclusions The findings show that the incidence of waterborne and foodborne diseases increased after meteorological disasters. General characteristics of disaster can influence the incidence pattern of diseases after disaster.

Abstract Number	**P-2-12-29**
Presenter	Amir Hakami*, Shunliu Zhao, Amanda Pappin, Morteza Mesbah, Joyce Zhang
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

The impact of a warming climate on ozone induced mortality

BACKGROUND: Ozone concentrations are expected to increase in a warming climate. This rate of change in ozone concentrations with temperature is referred to as the climate penalty factor (CPF). We use a mathematical approach called the adjoint method to estimate the sensitivity of total mortality due to short-term ozone exposure in North America to changes in temperature at any location. AIMS: We aim to identify areas where change in temperatures has the largest impact on population mortality due to short-term exposure to ozone. We also try to quantify by what magnitude these impacts differ from one location to another, and why high impact locations exhibit such behavior. METHODS: We use the adjoint sensitivity analysis modules developed for the USEPA's community multiscale air quality (CMAQ) model. This method enables us to differentiate between the North American mortality influences induced by changes in temperatures at various locations. We account for the impact of temperature rise on ozone through atmospheric chemistry, moisture content, and vegetative (biogenic) emissions. RESULTS: Our model-based estimations for CPF are in good agreement with regional trends observed in the eastern US (1.4 - 2.4 ppb/C). We estimate a total of 370 additional summertime deaths for each degree increase in atmospheric temperatures. Most importantly, the unique high-NOx environments in urban areas make their warming by far most influential in contributing to increased North American mortality. We attribute this significantly larger contribution in urban areas to the different role played by water vapor in such environments. CONCLUSIONS: We conclude that our results point to a) viability of urban NOx emission controls (i.e., mobile emission reductions) as a climate change adaptation measure, and b) sizeable contribution of the urban heat island (UHI) effect to North American air pollution mortality.

Abstract Number	**P-2-12-30**
Presenter	Kan Haidong*, Jing Zhang
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

The impact of temperature on mortality in three major Chinese cities

Background: Associations between temperature and health outcomes have been documented worldwide. However, few studies have examined the impact of temperature on mortality in China. Aims: To examine the temperature-mortality relationship and estimate the current and future temperature-related mortality in three major Chinese cities (Beijing, Shanghai, and Guangzhou). Methods: We collected daily mortality, weather and air pollution data in the three cities. We used distributed lag nonlinear model to analyze the lag structure of temperature's effect on mortality, and then estimated the current and future excess temperature-related mortality rate. Results: The association between temperature and mortality was U- or J-shaped, with increased death risk for both hot and cold temperatures in these cities. The effect of cold temperature lasted longer than that of hot temperature. Under the future scenarios of temperatures increase by 1˚C, 3˚C, and 5˚C, the estimated temperature-related mortality will increase since the decreases in the cold-related mortality rate will not offset the increases in the heat-related mortality rate. Among the three cities, Guangzhou is predicted to have the largest temperature-related mortality increase: 4% for a 1˚C increase, 16% for a 3˚C increase, and 35% for a 5˚C increase. Conclusions: Our findings may have implication for the climate policy of China because these temperature-related health impacts might be a strong inducement for the Chinese government to act to combat climate change.

Abstract Number	**P-2-12-31**
Presenter	Norma Isalia Villafán Figueroa*, María Guadalupe Garibay-Chávez
Exposure	climate change (temperature)
Health domains	other
Type of research	cross-sectional study

The impact of threats due to climate change on white corn production and adaptations to ensure food safety

Background: Mexico is an agricultural nation and corn is a basic staple of the population’s diet, 82% of Mexico’s production is harvested by dry-land farming. Jalisco contributes 20% of the country’s production of this cereal. Jalisco is vulnerable to climate change, particularly its agricultural sector. Aims: Analyze hydro-meteorological threats due to climate change, their effect on white corn production and on guaranteeing the population’s food demand. Methods: The information on harvested areas used for white corn dry-farming, yield and harvested areas affected by natural disasters from 2001-2010 was obtained from the Agriculture and Fishing Information Service. Historical records were analyzed to identify threats due to climate change that affecting corn production in Jalisco. Loss in corn production with respect to average yield per hectare at the municipal level and the population affected by such loss with respect to number of individuals impacted by the loss in production, and annual deaths due to undernourishment during this period were analyzed. Results:During 2000-2010, 51.82% of the land area in Jalisco was used for corn dry farming, the harvested production was 62.11% in tons and land that had suffered disasters was 5.81% in ha. The threats with impact on production at the municipal level were droughts, torrential rains and floods. The population exposed to the lost harvest totaled 6,920,638 pers/year on average. It is estimated that the people who suffered malnutrition due to a decrease in production were 553,651,032 pers/year. On average, 604 deaths/year were recorded as caused by malnutrition. Conclusions: the corn production in Jalisco has been affected by natural disasters. The climate change scenarios, corn production, the agricultural sector and the population that depends on this source of food are highly vulnerable.

Abstract Number	**P-2-12-32**
Presenter	Chisato Imai*, Masahiro Hashizume, Hae-Kwan Cheong, Ho Kim, Yasushi Honda, Jin-Hee Eum, Clara Tammy Kim, Jinseob Kim, Yoonhee Kim, Taypasavanh Fengthong
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

The impacts of global and local climates on dengue fever in Lao PDR and Cambodia.

Background: Climate change and climate variability are increasingly recognized as one of factors influencing emergence or re-emergence of vector-borne diseases such as dengue fever. For the past years, the increment of dengue has been observed and studies showed much evidence of strong correlations between climate variables and dengue cases. There is the potential increase in the latitudinal and altitudinal distribution of vector mosquitoes and dengue under global warming. Aims: This study was conducted to explore the associations between climate variables and dengue fever in Lao PDR and Cambodia. Methods: Dengue case data was obtained from three regions (North, Central, and South) of Lao PDR (2005-2010) and two cities (Phnom Penh and Siem Reap) of Cambodia (2006-2011). Time series analysis was performed to assess the associations with monthly climate variability, fitting global climate Southern Oscillation Index (SOI) and Dipole Mode Index (DMI)) and local weather variables (rainfall and maximum temperature) into generalized linear quasi-Poisson models. Result: The seasonality of dengue cases appeared to be mostly concomitant with rainy season (April to September) in both countries. Rainfall was positively associated with the number of dengue cases throughout the year in all locations whereas SOI showed a negative association. The effects of maximum temperature and DMI, on the other hand, varied depending on season and location, and the consistent pattern was hardly defined. Conclusion: In both countries, the number of dengue cases was positively and negatively associated with rainfall and SOI, respectively. The effects of maximum temperature and DMI were highly variable. Understanding the association between rainfall and SOI might assist further clarification of the impact of climate change on dengue fever.

Abstract Number	**P-2-12-33**
Presenter	Jennifer Nguyen*, Francine Laden, Mark Link, Joel D. Schwartz, Heike Luttmann-Gibson, Douglas Dockery
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	case-crossover study

Weather and Triggering Ventricular Arrhythmias in Patients with Implantable Cardioverter Defibrillators

Background Several studies have examined the association between outdoor ambient weather and ventricular arrhythmia (VA) with mixed results. Because people spend most of their time indoors, we hypothesized that weather-related arrhythmia risk is linked to indoor temperature and water content, a property of outdoor air that is conserved indoors. Aims We examined the association between weather and VA using three weather measures – outdoor ambient temperature, estimated indoor temperature, and outdoor absolute humidity. Methods The clinical records of 203 patients implanted with a cardioverter defibrillator at Tufts Medical Center (Boston, Massachusetts, USA) between June 1, 1995 and December 31, 1999 were abstracted for VAs between 1995 and 2002. We used case-crossover methods to link National Weather Service measurements made at Boston Logan International Airport to the date and time of VAs (specifically ventricular tachycardia and ventricular fibrillation). Indoor temperature was estimated from the outdoor temperature using results from an indoor weather study that characterized the relationship between indoor and outdoor temperature in Boston. We matched on month, day of the week, and hour, and adjusted for barometric pressure, ozone, and particulate matter in conditional logistic regression models. Results Among 84 patients who experienced 787 VAs (mean follow-up = 3.5 years), lower estimated indoor temperature (odds ratio (OR) = 1.16, 95% confidence interval (CI): 1.06 - 1.27 for an interquartile range (IQR) (0.97°C) decrease in the 24-hour average) and lower absolute humidity (OR = 1.37, 95% CI: 1.21 - 1.56 for an IQR (2.7 g/m3) decrease in the 96-hour average) were associated with increased risk. Lower outdoor temperature increased risk only in warmer months, likely attributable to the poor correlation between outdoor and indoor temperature during cooler months. Conclusions We observed associations between lower indoor temperature and drier air with increased onset of VA among patients with implantable cardioverter defibrillators.

Abstract Number	**P-2-12-34**
Presenter	Ton de Nijs, Ana Maria Roda Husman, Jack Schijven, Ankie Sterk*, Marcel van der Perk, Maria Stergiadi, Marc Bierkens, Oene Oenema, Tine Fierens, Arnout Standaert, Mirja Van Holderbeke
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	health impact assessment

Climate Cascades: Impacts of toxic substances and waterborne pathogens on man and ecosystems

Background and Aims Climate change, changes in temperature, precipitation and drought patterns will affect the structure and composition of our soils by changes in vegetation cover, food-web structure and soil formation processes, in particular the production and degradation of organic matter. These changing environmental conditions may enhance the run-off and release of nutrients, toxic substances and pathogens. Moreover, adaptation and mitigation strategies to tackle the impacts of climate change may also affect soil structure and composition. If our soils change, the composition of our groundwater and surface water will change. There is a need for appropriate methods to conceptualize the full chain of events leading to potential effects on man and ecosystems – i.e., climate cascades. This study aims to develop the methods to simulate this chain of events and assess the potential impacts of toxic substances and waterborne pathogens on man and terrestrial and aquatic ecosystems that result from the effects of climate change on soil, groundwater and surface water at the river basin scale. Methods and Results A modeling framework will be developed conceptualizing this chain of events consisting of a dynamic, spatially detailed river basin model and a probabilistic risk assessment model. The river basin model will be used to estimate future distributions of soil, groundwater and water parameters needed in the risk assessment model. The distributions will be used in the risk assessment models to estimate the probable risks of exposure to toxicants and pathogens for man and aquatic and terrestrial ecosystems. Model simulations of a limited number of scenarios will reveal the changing environmental dynamics and the potential impacts on man and ecosystems. Conclusions The project will result in a modeling system describing the chain of events, designed to evaluate the potential impacts of climate change on the distribution of toxic substances and pathogens over the environment and the risk for man and ecosystems.

Abstract Number	**P-2-13-01**
Presenter	Kathleen M. Navarro*, Jennifer K. Mann, Srinandini Parthasarathy, John R. Balmes, Thomas E. McKone
Exposure	biomarker
Health domains	no health domain
Type of research	exposure modeling

Association of Food Intake with Urinary Polycyclic Aromatic Hydrocarbons Levels in a Nationally Representative Sample

Background: Polycyclic aromatic hydrocarbons (PAHs) are hazardous air pollutants derived from incomplete combustion of organic compounds. PAHs in food arise through direct contamination from environmental and industrial sources and through preservation and processing procedures. Objective: The goal of this study was to assess the contribution of different foods to levels of PAHs found in the human body. Previous studies have indicated that food is a contributor of exposure to PAHs, but have not identified which specific foods. Methods: Data from the 2001-2006 National Health and Nutrition Examination Survey were used to explore the association of 8 urinary PAH metabolites adjusted for creatinine with food intake of 21 specific food types, identified from the 24-hr dietary recall. Associations of food and urinary PAHs were assessed in single-food multiple linear regression models, adjusted for demographic and socioeconomic factors, house type, and smoking status, high blood pressure, and high total cholesterol. All p-values were adjusted for multiple comparisons using the False Discovery Rate method. Results: In the multiple regression analysis, coffee and meat consumptions were positively associated with several PAH metabolites. Levels of 2-hydroxynapthalene and 1-hydroxyphenanthrene were positively associated with berry consumption. Fish, cereal, and citrus intake was negatively associated with the level of several PAH metabolites. For example, we found that a 10 percent increase in coffee consumption was associated with a 0.3% increase in the level of creatinine-adjusted 3-hydoxyfluorene. Conclusion: PAH concentrations increased with ingestion of both meat and coffee. Even with adjustment for participant's health characteristics, there were some foods that were negatively associated with PAH levels. These results offer insight for future exposure modeling studies to estimate PAH exposures from food. Future research with this data could examine the roles of food preparation and preservation on the levels of PAHs in the body.

Abstract Number	**P-2-13-02**
Presenter	I Fang Mao*, Chung Jung Tsai, Chin Chi Mao, Lee Wang, Mei Chien Chen
Exposure	biomarker
Health domains	no health domain
Type of research	occupational study

Biological monitoring and health effect assessment of arsenic exposure for workers in electro-optics and semiconductor high-tech industries

Abstract Arsenic compounds have been played an important role in electro-optics and semiconductor industries. However, the arsenic is harmful to the workers, particularly for the equipment maintenance and clean workers. The objectives of the study are to evaluate the personal exposure of arsenic by biomonitoring the total arsenic concentrations (tAs) in blood, and to do the health effect assessment by subjective syndromes, blood biochemistry, DNA methylation and urinary 8-hydroxy-2-deoxyguanosine (8-OHdG) concentrations for these workers. The study subjects were 133, including exposure group 74 and control group 59 . The results indicated that abnormal % of SGPT and SGOT were higher in exposure subjects than those in control subjects (P<0.05). Regarding the tAs in blood, the concentrations were 10.96±3.73 μg/L in exposure group and 11.09±2.58 μg/L in control group； The tAs of blood in semiconductor industry subjects (11.93±2.32 μg/L) were significantly higher than those in electro-optics industry subjects (10.41±3.64 μg/L) (p<0.01), and the tAs of blood in maintenance and clean workers (11.63±4.42 μg/L) were higher than those in control workers (10.03±2.23 μg/L) (p<0.05). The tAs of blood were significantly correlated with the consumption of seafoods. The 8-OHdG level in semiconductor industry subjects (4.44±2.98 μg/g crn) were higher than those in electro-optics industry subjects (3.39±2.57 μg/g crn). Regarding to the DNA methylation, there is no significantly different between exposure group and control group in p16 gene or p53 gene, individually. The study concluded that source of the worker's blood arsenic concentration was from seafood intake rather than worker's occupational exposure.
Key Words: electro-optics,semiconductor,workers,arsenic exposure,biological monitoring, blood arsenic,8-OHdG,DNA methylation

Abstract Number	**P-2-13-03**
Presenter	Tobias Weiß*, Holger M. Koch, Heiko U. Käfferlein, Stephan Koslitz, Hendrik Modick, Georg Dierkes, Jürgen Bünger, Christian Monsé, . Marek
Exposure	biomarker
Health domains	other
Type of research	exposure measurement

Biological Monitoring of Aromatic Amines - Metabolism of aniline and elimination kinetics of its metabolites after controlled exposure

The aromatic amine aniline is an important base material in chemical industry. It is also an integral part of tobacco smoke. In Biological Monitoring exposure to aniline is regularly assessed by measuring urinary aniline after hydrolysis or in form of its covalent haemoglobin adducts. As data on metabolism and elimination kinetics is available from several animal species but lacks from humans we conducted a study under controlled exposure in an exposure chamber (ethics approval 4333-12, Ruhr-Universität Bochum). Four non-smoking slow acetylating volunteers (2 m, 2 f) were exposed to 2 ppm aniline for 8 hours. Spot urine specimen were taken prior to exposure and ad libitum up to 26 hours postexposure. In these samples N-acetyl-2-aminophenol, N-acetyl-4-aminophenol and N-acetylaniline were quantified using HPLC-MS/MS and aniline was quantified after acidic hydrolysis using GC-MS/MS. N-acetyl-4-aminophenol was the major urinary metabolite representing 23-54% of the total aniline dose. N-acetyl-4-aminophenol was eliminated into urine with a half-life between 6 and 12 hours. Urinary background concentrations of N-acetyl-2-aminophenol in the mg/L range hampered the evaluation of toxicokinetic data for this proposed phenolic aniline metabolite. The amount of aniline found after hydrolysis essentially originated from N-acetylaniline. N-acetylaniline showed an initial elimination half-life of about 3 hours. N-acetylaniline accounted for less than 0.5% of the dose which is considerably smaller than expected from animal data. If the acetylator phenotype has a significant impact on metabolite ratios or elimination velocity in humans will be studied in further experiments. The sources of the N-acetyl-2-aminophenol urinary background concentrations in humans are unknown so far.

Abstract Number	**P-2-13-04**
Presenter	Jean Johnson*, Christina Rosebush, Jessica Nelson, Gonza Namulanda
Exposure	biomarker
Health domains	other
Type of research	review

Biomonitoring and Environmental Public Health Tracking: Making the Link

Background: The National Environmental Public Health Tracking Network (Tracking Network) is a web-based information system of standardized health and environmental data established in 23 states and New York City. State and national partners work together with the US Centers for Disease Control and Prevention to provide data that informs public health action, and furthers our understanding of the impacts of environmental contaminants on public health. The Tracking Program's Biomonitoring Task Force is assessing state/community-level biomonitoring data for use on the Tracking Network. Methods: In 2012, we evaluated information provided by funded Tracking states to assess available biomonitoring data maintained in state and local agencies from projects or program activities completed over the past 10 years. Data were assessed in 5 categories: mandatory reports (under state law), population-based surveillance, targeted investigations, support of academic research, and rapid response. Results: Results showed that 13 of 21 Tracking states collect mandatory reports of exposure (poisonings) for one or more chemicals (in addition to children's blood lead), most commonly for metals. Population-based statewide surveillance data are currently available in 5 states, 4 of these with sample sizes exceeding 1,000 participants and 93% funded by federal grants. Most available data are from targeted investigations with sample size less than 500, using non-probability based sampling designs. Seventy percent of these targeted investigations relied on state public health laboratories for analyses. Conclusions: While most Tracking states have limited data available, many have established laboratory and epidemiological capacity for biomonitoring. Biomonitoring in state and local public health agencies has demonstrated utility for tracking vulnerable community exposures and disparities that can supplement data collected in large national surveys for informing local public health action.

Abstract Number	**P-2-13-05**
Presenter	Huang Yung-Kai*, Bou-Yue Peng, Chia-Yo Wu, Hung-Che Lai
Exposure	biomarker
Health domains	cancer
Type of research	case-control study

Combine testing of environmental exposure and epigenetic biomarker in the detection of oral cancer

Background: The high incidence of oral cancer (OC) is directly related to betel nut chewing. Limited studies have reported the association between epigenetic biomarkers and/or environmental exposure to betel nuts in OC. Objects: The aim of this study was to identify the relationship between this environmental exposure and the DNA methylation status of several genes in OC. The genes evaluated included sex-determining region Y- box 1 (SOX1), paired box gene 1 (PAX1), and zinc-finger 582 (ZNF582). Methods: A age matched case-control study was conducted at Taipei Medical University Hospital, Taiwan. DNA was extracted from 37 cases and 40 controls oral swabs and the methylation status of three genes was determined by quantitative methylation polymerase chain reaction (QMSP). Result: Of all betel nut chewers, 88% exhibited high methylation levels of ZNF582. Combined testing of either SOX1 or PAX1, the 100% and 86.4% sensitivity were showed in betel free subjects and in betel chewer, respectively. Combined testing of SOX1 and PAX1methylation, the 91.7% and 100% specificity were showed in betel free subjects and in betel chewer, respectively. Conclusion: This is the first study proves a phenomenon of environmental-epigenetic interaction in OC. Further study should focus on those markers in larger populations, as well as their molecular functions in the carcinogenesis of OC.

Abstract Number	**P-2-13-06**
Presenter	Rebecca Rehr*, Gregory G. Miller, Brenda Foos
Exposure	biomarker
Health domains	healthrelated quality of life
Type of research	review

Concepts for Including Children's Health in a Sustainable Future

Sustainability has traditionally focused on resource use, often failing to address children's health. Children are more susceptible to environmental hazards than adults because their vital organs are still developing; they exhibit different behaviors than adults; and they ingest more food, breathe more air, and drink more water per pound of body weight than adults. This research examines the intersection between children's health and sustainability, identifying best practices to more fully incorporate children's health into efforts to achieve sustainability. Further, we examine the use of children's environmental health indicators as one tool to evaluate existing sustainability initiatives, using the example of the United States Environmental Protection Agency (EPA). Children's environmental health indicators can serve as good measures of sustainability, as they often address all three pillars of sustainability – economics, environment, and social – and are applicable worldwide. For example, identifying elevated blood lead levels in children can serve as an impetus for action to prevent exposure and/or remediate adverse health outcomes caused by lead exposure. The lead case is illustrative of the principles behind sustainability. Lead exposure often occurs in low-income neighborhoods (economic), in several media (environment), and affects neurocognitive development (social). Lead exposure early in life can lead to lifelong health effects. Protecting children as they progress through each lifestage (i.e. from parental health at the time of conception through fetal and maternal development, infancy, and adolescence) is a key building block for a healthy population and a sustainable future. EPA's experiences in this arena may serve as a reference for organizations around the world working to achieve sustainability by balancing environmental, economic, and social wellbeing.

Abstract Number	**P-2-13-07**
Presenter	Maire S.A. Heikkinen*, Susan Marie Viet, Michael Dellarco
Exposure	no exposure
Health domains	other
Type of research	review

Considerations for environmental sample storage, laboratory analysis, and results reporting

A longitudinal birth cohort study, such as the U.S. National Children's Study (NCS), presents several challenges when designing and implementing environmental sample collection, storage, analysis, and results reporting. In order to investigate many hypotheses, a variety of different types of environmental samples will be collected. Samples that cannot be stored will be analysed immediately, but for logistical reasons, many of the samples will be stored prior to analysis for an indeterminate time period. The approaches and factors that must be considered include storage stability of samples and target analytes, additional and yet unknown target analytes, maintaining analytical method comparability, and analysis results data reporting and storage. The NCS has prepared plans for storage stability studies of particulate matter, tap water, and various dust samples where quality control samples will be stored both prior to sample collection to evaluate the sample stability and stability of analytes in extracts and concurrently as the study samples are collected and stored. Based on the experiences in the Initial Vanguard Phase and experiences in other studies, the NCS plans to employ established analysis methods, when available, and consider alternate methodologies, when warranted. When analysis methods change, a number of study and stored QC samples will be analysed by both methods to maintain comparability. The NCS approach to sample analysis results reporting is to require electronic data deliverables in formats anticipated to be accessible decades after samples were collected: study and laboratory QC sample results in standardized, structured files either in XML or CSV, and the detailed measurement and background data in standard or customized data packages in PDF. The file structures and formats depend on the analytical method and target analytes in the method. The data are verified and validated before archiving.

Abstract Number	**P-2-13-08**
Presenter	Knut Rauchfuss*, Martin Kraft, Wilhelm Michael
Exposure	biomarker
Health domains	neurobehavioral effects
Type of research	review

Derivation of a health based guidance value for PCB in human blood samples

Polychlorinated Biphenyls (PCB) are persistent synthetic organochlorines. Due to their lipophilicity they accumulate in the food chain and in human lipid tissue, and can cause a variety of dose-dependent adverse health effects in different tissues and organs. Although their prohibition in the early 1980ies led to a significant decrease of the body burden of the population, PCBs are still widespread due to their high persistency in the environment and may still be emitted, e. g. in case of improper recycling. A critical literature review was carried out, to weight the evidence of the current state of research on health effects of PCB, under special consideration of publications from the recent years. Based on this review the critical toxic endpoints were identified; key studies on the dose response relationship based on human data were selected, and critical effect levels in human blood were derived. The risk assessment was based on neurotoxic and immunotoxic PCB-effects as most sensible critical endpoints. Both have been largely investigated epidemiologically, mostly in birth cohorts, from which age-dependent neurodevelopmental deficits were reported for newborns and infants. Also elevated incidences of infections, lower allergy rates, suppressed immune responses on vaccinations, and shifts in certain lymphocyte-subpopulations were associated with the pre- and postnatal PCB exposition in several cohort studies. Data from animal studies supports the epidemiological findings. Therefore children were identified as the most vulnerable group. The overall result of the risk assessment showed that below concentrations of 0.5 µg total PCB / g blood lipid no adverse health effects may occur. Based on this risk assessment the German “Human Biomonitoring Commission” derived the following HBM values for total PCB: HBM-I = 3.5 µg PCB/L serum; HBM-II = 7 µg PCB/L serum for children and women at childbearing age.

Abstract Number	**P-2-13-09**
Presenter	Young Lim Kho*, Jung Hoan Kim, Eun-Hee Lee, Kyungho Choi, Byung-Jo Ha, Sangshin Park
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	exposure measurement

Determination of perfluorinated compounds in human breast milk by liquid chromatography–triple quadrupole mass spectrometry

Background : Perfluorinated compounds (PFCs) have both lipophilic and hydrophilic properties and are used in many applications. PFCs are able to bio-accumulate and cause adverse effects to animals and human health, particularly in the case of an exposure during the early stages of development. Aims :We evaluated the method of solvent extraction and solid phase extraction coupled with LC-MS/MS technique to analyze perfluorinated compounds in human breast milk for assessing newborn exposure to PFCs. Methods :Human breast milk samples were pretreated by solvent extraction and solid phase extraction. Fifteen PFCs were analyzed by LC-MS/MS technique. Method validation was performed by blank test, linearity, LOD, accuracy and precision. Results :The linearity obtained was very satisfying for all perfluorinated compounds, with a coefficient of determination (R2) higher than 0.99. The limits of detections ranged from 0.03 to 0.2 ng/mL for breast milk samples. The accuracies of method ranged between 70.4% and 109.7% for high and low concentrations in PFCs spiked samples. Conclusions :We performed this study to evaluate the feasibility of LC-MS/MS technique for analyzing PFCs in human breast milk.

Abstract Number	**P-2-13-10**
Presenter	Gerd Sallsten*, Magnus Akerstrom, Thomas Lundh
Exposure	biomarker
Health domains	other
Type of research	exposure measurement

Effect of Molybdenum Oxide Interference on Urinary Cadmium Analyses

Background and aims Molybdenum (Mo) is an essential element for humans. The main source of Mo is the diet, and the urinary excretion of Mo is directly related to recent dietary intake. During metal analysis, using inductively coupled plasma mass spectrometry (ICP-MS), molybdenum oxide (MoO) is formed from Mo in urine and interference with cadmium's (Cd) most abundant isotopes could potentially occur. Our aim was to assess the impact of MoO-based interference on urinary Cd (U-Cd) analyses at low Cd exposure. Methods Frozen urine samples were reanalysed, using ICP-MS, in a study of 152 healthy kidney donors, consisting of both 24h urine (U24, n=131) and overnight urine (UON, n=146) samples collected in 1999-2006, since it was discovered that only half of the samples initially were corrected for MoO-based interference. The impact of MoO-based interference was assessed by comparing the results of the initial- and the reanalysis. Results Repeated measurement of specific gravity (n=20) showed good agreement with the measurements done on fresh urine, indicating no dehydration of the stored samples. After the reanalysis, the U-Cd concentration in U24 and UON samples previously not corrected for MoO-based interference were reduced by 55% and 38% respectively, while the samples that initially were corrected remained practically the same. Mean levels of Mo in urine were between 22 µg/L and 39 µg/L in the different groups. Conclusions For U-Cd analyses at low Cd exposure, MoO-based interference may have a strong impact on the U-Cd concentration and correction for MoO-based interference is therefore often needed.

Abstract Number	**P-2-13-11**
Presenter	Syam S. Andra*, Joseph Kermah, Konstantinos C. Makris, Costas A. Christophi, Michael Petrou, David C. Christiani, Christos S. Mantzoros, Stefanos N. Kales
Exposure	biomarker
Health domains	obesity
Type of research	cohort study

Hair Ionomic Profiles and Associations with Obesity Indicators from a Cypriot Young Adult Male Cohort

Obesity is recognized as an important metabolic risk factor for a plethora of chronic diseases, including diabetes mellitus and cardiovascular diseases. Obese people are likely at a higher risk of developing deficiency for elemental nutrients such as magnesium, and/or having excess of certain toxic trace elements such as copper. Hair is a unique biological matrix that provides retrospective snapshot of environmental/dietary exposures. We hypothesized that perturbation in hair ion profiles serve as pre-stage indicators of obesity onset. This study aimed at exploring associations of trace elements and essential macronutrients profiles in hair with clinical and dietary measurements of obese people compared to healthy controls. Archived hair samples from the Cyprus Metabolism Prospective Cohort Study on young adult male sub-population was randomly selected for (i) normal weight (n=50), (ii) overweight (n=50), and (iii) obese (n=50) participants with BMI of <25, 25-30, and >30 kg m-2, respectively. Inductively coupled plasma mass spectrometry was used for high throughput profiling of 20 trace, toxic, and essential elements: antimony, arsenic, barium, calcium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, sodium, vanadium, and zinc. Univariate and multivariate logistic regression analyses will be performed to evaluate associations between hair ionomic profiles and obesity indicators such as (i) adiposity measures (e.g. body mass index, waist-to-hip ratio), (ii) metabolic risk indicators (e.g. cholesterol, metabolic syndrome), (iii) biochemical markers (e.g. leptin-binding protein, triglycerides), and iv) questionnaire-based self-reported dietary habits. Information on how obese and normal individuals differ in terms of hair elemental composition may help to understand their role as a cause or effect of obesity. Further insight on links between obesogen elemental mixtures and endocrine disruptors (such as zinc, cadmium, mercury) may be possible.

Abstract Number	**P-2-13-12**
Presenter	Eliana Wendland*, Luciane François, Maria Goreti Vale, Adriana Almeida, Morgana Bazzan Dessuy, Giovanni Torri, Daniel Santana, Demétrio Luis Guadagnin
Exposure	biomarker
Health domains	no health domain
Type of research	cross-sectional study

Is game meat consumption associated with lead levels in nails?

Background: Wild game meat consumption is a popular habit in many regions in south Brazil, despite the hunting activity be prohibited all over the country. Lead bullets fragments are frequently found in game meat and can be incidentally ingested, causing health risks. Unlike blood, that gives transitive lead concentration, the measurement of Pb in nails is considered to reflect long-term exposure. Aims: This study evaluate the association between game meat consumption and long-term lead concentration in fingernail. Methods: Fingernails samples were collected using clean stainless steel scissors, from 43 participants recruited in five rural areas of south Brazil. Enrolled subjects live in areas prone to have game (wetlands) and the neighbors were used as controls as well a sample of 18 practitioners of outdoor shooting. Socio-demographic status, lead exposure source and frequency and type of wild game consumptions where also collected. Mass Spectrometry technique after sample digestion with Tetramethylammonium hydroxide was used to measure Nail-Pb. Results: Most of the participants were males (65,6%), declared itself as white (78.9%) and have low educational level (less than 8 years – 38.2%). Despite 70.5% lives in rural areas, only 59% are farmers. 36.7% of the subjects declared to hunt and 74.6% declare do eat game, being duck, quail and wild boar the most prevalent. There was a significant difference between lead levels in nails between sex (men= 3.34µgg, women=0.36µgg; p t-test=0.02), but not between hunters (ANOVA p= 0.61) or eating game subjects (ANOVA p=0.35). Conclusions: The habits of hunting or consumption of wild meet seem not to be associated to a higher exposure to lead South Brazilian population. Men were more chronically exposed to lead than women.

Abstract Number	**P-2-13-13**
Presenter	Marike Kolossa-Gehring*, Ulrike Fiddicke, Gabriele Leng, Holger M. Koch, Petra Apel
Exposure	biomarker
Health domains	no health domain
Type of research	exposure measurement

New human biomonitoring methods for chemicals of interest

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)and the German Chemical Industry Association e. V. (VCI) started their cooperation to increase the knowledge on the internal exposure to chemicals of the general population in 2010. Emphasis is placed either on substances with potential health relevance or on substances to which the general population might potentially be exposed to a considerable extent. Substances of interest are identified by a scientific advisory panel in cooperation with the Federal Scientific Agencies in charge of chemical regulation and VCI. New human biomonitoring (HBM) methods have been finished as part of the VCI tasks for the sensitizing agent methylenediphenyl diisocyanate (MDI), 2-mercaptobenzothiazole (MBT) used as a vulcanization accelerator for rubber products, the two plasticisers Hexamoll® DINCH and Di-2-propylheptyl phthalate (DPHP) used as substitutes for Di-2-ethylhexyl phthalate, as well as N-methyl-2-pyrrolidone and N-ethyl-2-pyrrolidone used as solubilising agents. First exposure data generated using the new methods in a small number of samples indicate that some of the chemicals do not seem to lead to a detectable background exposure of the occupationally non-exposed population. However, for DPHP and DINCH analysed in samples from the German Environmental Specimen Bank time trends show that their use in products with direct consumer contact is related with exposure of the general population. The relevance of these findings is to be assessed by derivation of toxicologically derived Human-Biomonitoring-Values as well as by population representative HBM studies. Those and 5 additional methods expected by the end of 2013 will be applied in the 5th German Environmental Survey which is under preparation. The results will contribute to a realistic estimation of human exposure to relevant chemicals in the German population and be used for sound risk assessment on these chemicals of interest.

Abstract Number	**P-2-13-14**
Presenter	Su Ryeon Noh*, Jung Ah Kim, Gwi Heum Eom, Yong Jin Jeon, Hyun Sook Bae, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	biomarker
Health domains	other
Type of research	cohort study

Oxidative Stress Biomarkers in Residents 4 years After the Hebei Spirit Oil Spill

Background: We found a dose-response relationship between the severity of exposure to spilled crude oil and oxidative stress biomarkers even 1.5 years after the Hebei Spirit oil spill accident occurred in December 2007. Follow-up oxidative stress biomarker studies were undertaken approximately 3 years and 4 years after the accident in residents who live in highly exposed areas. Aims: This study was to assess the possible long-term persistence and recovery associated with the exposure to complex mixtures of spilled crude oil. Methods: Residents qualified for the follow-up studies were those whose residence is located within 8 km from the early contaminated coastline among the baseline cohort population. A total of 161 participants were enrolled at three times in February to April, 2009, October to November, 2010, and February to March, 2012. Urinary 8-hydroxy-2'-deoxyguanosine (8-OHdG) and urinary malondialdehyde (MDA) levels were measured as indicators of oxidative DNA damage and lipid peroxidation, respectively. Results: The geometric mean of urinary 8-OHdG and MDA levels, 1.5 years, 3 years, and 4 years after the disasters were 6.0, 6.3, and 6.7 μg/g creatinine (cr) and 3.5, 2.6, 2.5 μmol/g cr, respectively. The urinary 8-OHdG levels had slightly increased as time passed in highly affected group, but the oxidative stress biomarkers did not correlate with the clean-up work duration and the distance indicators any longer adjusting for potential covariates 3 years and 4 years after the Hebei Spirit oil spill. Conclusions: Although time passed, the urinary 8-OHdG levels hardly changed during the follow-up period. Increased 8-OHdG levels might be related to the emergence of chronic progressive diseases, such as respiratory, allergic inflammatory, obesity, diabetes, atherosclerosis, and cancer.

Abstract Number	**P-2-13-15**
Presenter	Mei-Lien Chen*, Yen-An Tsai, Ben-Hua Su, Chia-Huang Chang, Hsiao-Yen Chen, Bao-Chi Liao, Shu-Li Wang
Exposure	biomarker
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Phthalate exposure and neurobehavioral development at early childhood

Background: Phthalates acid esters (PAEs) are primarily used as plasticizers. The findings of reproductive toxicity as well as endocrine disrupting effects of PAEs have raised great attention worldwide. The objective of the study is to assess the association between early childhood neurobehavioral development and phthalates exposure. Methods: Urine sample from the third trimester of 74 pregnant women and children paired at age of 2 years old were collected. Phthalate metabolites (MMP, MEP, MnBP, MBzP, MEHP, MEHHP and MEOHP) were measured by LC-MS/MS. We assessed the children's mental (MDI) and psychomotor (PDI) developmental indices at the age of two by using the Bayley Scales of Infant Development-II (BSID-II). Results: We found no association between maternal phthalate exposure and children's neurobehavioral development. However, after adjusting gender, maternal age and education level, family income and breastfeeding, regression model showed that MDI was inversely associated with children's urinary MBP (mono-n-butyl phthalate) concentrations.Comparing children with MBP concentrations below 25%, the MDI were reduced by -7.969 (95%CI: -14.577~-1.360) and -9.252 (95%CI: -17.019~-1.484) for those with 25%-75% MBP and >75% MBP, respectively. Conclusions:The results suggest that certain phthalates exposure at early childhood may increase risk of mental development.

Abstract Number	**P-2-13-16**
Presenter	Julie Herbstman*, Shuang Wang, Frederica Perera, Sally Lederman, Julia Vishnevetsky, Andrew Rundle, Lori Hoepner, Leena Qu, Deliang Tang
Exposure	biomarker
Health domains	no health domain
Type of research	cohort study

Predictors and consequences of global DNA methylation in cord blood and at three years

Background: DNA methylation changes have been implicated in many common chronic diseases leading to the hypothesis that environmental and age-related methylation changes within individuals are involved in disease etiology. Few studies have examined DNA methylation changes within an individual over time and all of these studies have been conducted in adults. Aims: Here, we aim to characterize how global DNA methylation changes from birth to age three within a longitudinal birth cohort study and to determine whether there are consistent predictors of methylation levels measured three years apart. Methods: We measured global DNA methylation in the same children at birth (cord blood) and again at three years of age (n=165), using an immunoassay. We compared global DNA methylation at birth and at age three using correlation and permutation analysis. We used multiple linear regression models to identify predictors of methylation at both time points. Results: On average, DNA methylation was significantly higher in blood at age 3-years than in cord blood ($p<0.01$). However, for any individual child, the difference was less than would be expected by chance (p-value from permutation analysis <0.01). Self-reported maternal pre-pregnancy BMI was negatively predictive of both cord and three-year methylation, even after statistical adjustment to account for the correlation between cord blood and three-year DNA methylation. Conclusions: The biologic implications of small changes in global methylation are unknown. However, the observation that global methylation levels are maintained within an individual from birth to age three is consistent with other evidence suggesting that factors that influence global methylation in early life, including pre-pregnancy BMI, may confer long-term effects.

Abstract Number	**P-2-13-17**
Presenter	Nadia Vilahur*, Hyang-Min Byun, Mariona Bustamante, Marina Vafeiadi, Raquel Garcia, Xavier Estivill, Mariana F. Fernandez, Andrea A Baccarelli, Jordi Sunyer
Exposure	biomarker
Health domains	no health domain
Type of research	cohort study

Prenatal exposure to xenoestrogens and placental DNA methylation of repetitive elements.

Background: Prenatal exposure to endocrine disrupting chemicals (EDCs) has been shown to disrupt a number of physiological processes both in males and females, and may be related to disease outcome in adult life. In particular, in the INMA (Infancia y Medio Ambiente) birth cohort, higher Total Effective Xenoestrogenic Burden (TEXB) levels in placenta have been associated with increased birth weight in boys. Changes in DNA methylation in genomic repetitive elements may be a potential molecular mechanism underlying these effects. Aim: To explore the effect of exposure to environmental xenoestrogens during pregnancy on global DNA methylation in placenta. Methods: The TEXB biomarker, measuring the combined effect of mixtures of xenoestrogens using the E-Screen bioassay, was assessed in 200 placentas (50.5% males). The % of DNA 5mC was analyzed per duplicate on 10 different repetitive elements (4 LINEs, 3Alus and 3 HERVs) by bisulfite pyrosequencing. One to five CpG sites were analyzed depending on the retrotransposon. Methylation levels (average methylation of all CpGs) were regressed over tertiles of TEXB levels using linear mixed-effect models with cross random effects. Maternal characteristics during pregnancy (active smoking, educational level and age) and pre-pregnancy BMI were included as fixed-effects. Effect modification by sex was tested with the Wald z-test and Bonferroni correction was used to account for multiple testing. Results: Higher TEXB levels (3rd vs 1st tertile) were associated with an increase in methylation of 1.2% in L1PA5 (P value<0.001), without significant sex interactions. No significant associations were found for the Alu and HERV elements. Conclusions: Significant changes in DNA methylation were found only in one out of the 10 elements analyzed, with a small increase in DNA methylation upon high TEXB levels. Since xenoestrogens emulate endogenous estrogens, they may affect methylation at specific hormone-regulated genes. To address this, genome wide DNA methylation will be analyzed on these samples with the 450K Illumina Array.

Abstract Number	**P-2-13-18**
Presenter	Seokyong Lee*, Sunguk Youn, Sunshin Kim, Gayeon Hong, Wonho Yang
Exposure	biomarker
Health domains	other
Type of research	occupational study

Relationship of Oral Health Promotion between Effects of Tooth brushing Frequency and Smoking

Background: One of main causes of dental caries and periodontal disease, significant stomatosis causing deterioration of oral health and loss of teeth plaque and smoking is known as its environmental cause also. The most effective way to control dental plaque is tooth brushing and daily tooth brushing frequency is a major factor to prevent significant stomatosis. Aims: The first purpose of this study is to assess effects of tooth brushing frequency and smoking on oral conditions by analyzing Patient Hygiene Performance(PHP) index depending on the tooth brushing frequency and smoking. Second, it's intended to assess the tooth brushing frequency and smoking on cotinine level by analyzing urinary cotinine concentration depending on the tooth brushing frequency and smoking. Methods: In this study, first, for PHP index depending on the tooth brushing frequency and smoking, questionnaire survey and oral examination were conducted against 111 men in their 20s. Second, the correlation between daily tooth brushing frequency and urinary cotinine level was drawn from the results of 'Gwangyang Industrial Complex Health and Nutrition Survey' performed by National Institute of Environmental Research' from 2007 to 2010. Results: Overall PHP index according to general features was 'poor' level as 2.60. Lower tooth brushing frequency, smoking, and more number of cigarettes were related to higher PHP index. For the cotinine level of total subjects against their tooth brushing frequency, it was found that when the tooth brushing frequency increased, the cotinine level was reduced as 442.38 ug/L for 0 time a day and 60.0 ug/L for 4 times a day, showing statistical significance ($p<0.05$). Conclusions: This study indicates that tooth brushing has a potential to reduce exposure to environmental hazardous factors and presents need of below related studies in future.

Abstract Number	**P-2-13-19**
Presenter	Liza Valentín-Blasini*, Rey Decastro, Benjamin Blount
Exposure	biomarker
Health domains	cardiovascular disease
Type of research	exposure measurement

Thiocyanate as a Biomarker for Cyanide Exposure in the U.S. Population

Background: Tobacco smoke exposure is one of the major causes of lung cancer, respiratory infection, and heart disease. Cyanide, one of many toxic chemicals present in tobacco smoke, is considered the major contributor to the cardiovascular toxicity of tobacco smoke. Good biomarkers to reliably measure cyanide exposure are therefore critical. Urinary levels of thiocyanate, the main metabolic product of cyanide, can be used to assess cyanide exposure. Aims: To evaluate human exposure to cyanide by measuring urinary concentrations of its metabolite, thiocyanate. Method: We measured urinary thiocyanate levels in samples from U.S. residents, ages 6 years and older, during 2001 – 2012 as part of the National Health and Nutrition Examination Survey (NHANES) using ion chromatography-tandem mass spectrometry. Results: When geometric means of urinary thiocyanate levels were adjusted for age, fasting, sex, smoking status and race-ethnicity, significantly higher levels of urinary thiocyanate were detected in smokers compared with non-smokers. Conclusion: These data provide an updated population-based assessment of the magnitude and prevalence of cyanide exposure in the U.S. population. Differences in urinary thiocyanate levels between smokers and non-smokers indicate cyanide exposure is largely driven by exposure to tobacco smoke.

Abstract Number	**P-2-13-20**
Presenter	Joseph Braun*, Melissa Eliot, Kimberly Yolton, Bruce Lanphear
Exposure	biomarker
Health domains	no health domain
Type of research	cohort study

Trends and Patterns in Urinary Phthalate Metabolites during Early Childhood

Background: Phthalates are used in PVC plastics, food packaging, and personal care products. Use of phthalates in certain children's products has been regulated in some countries due to possible toxicity, but whether this has resulted in reduced exposure among children is unknown. Aims: To describe temporal patterns and predictors of early childhood phthalate exposure. Methods: Urine samples, socioeconomic status (SES) and children's dietary information were longitudinally collected from children in the Health Outcomes and Measures of the Environment Study from ages 1 to 5. Phthalates were grouped into di-2-ethylhexyl (DEHP), high molecular weight (HMW), and low molecular weight (LMW) metabolites. We used linear mixed models to estimate phthalate metabolite differences over time and according to sociodemographic and dietary factors. Results: We collected 1,100 urine samples from 325 children. After adjustment for SES, age, and sex, black children had LMW phthalate concentrations 60% higher (95% Confidence Interval [CI]:33, 93) than whites, but similar HMW and DEHP metabolite concentrations. Diet was not associated with phthalate metabolites. LMW metabolites decreased by 37% between 2003 and 2006 after adjustment for age (CI:-55, -13) and by 43% per year in age after adjustment for year of birth (CI:-46, -41). Age associated changes in DEHP and HMW metabolites depended on year of birth, where children born later had larger declines in metabolite concentrations. DEHP and HWM metabolite concentrations declined 16% and 23% per year among children born in 2003, respectively vs. 31% for both metabolites among children born in 2006. A 3-year old born in 2006 had DEHP and HMW metabolite concentrations 7% and 14% lower than a 3-year old born in 2003, respectively. Conclusions: Exposure to phthalates decreased over the course of the study as a result of both increasing age and trends in exposure over time, suggesting that regulations implemented in 2008 may have resulted in reduced phthalate exposure among children in the US.

Abstract Number	**P-2-13-21**
Presenter	Kyungho Choi*, Sungeun Kang, Sunmi Kim, Jeongim Park, Hae-Joong Kim, Jeongjae Lee, Gyuyeon Choi, Suyoung Kim, Hyo-Bang Moon, Sungkyoon Kim, Young Lim Kho
Exposure	organic compounds
Health domains	other
Type of research	cross-sectional study

Urinary paraben concentrations among pregnant women and their matching fetuses of Korea, and the association with oxidative stress biomarkers

Parabens have been used in multiple products including personal care products, pharmaceuticals, and foods for more than 50 years but several studies have raised concerns on their safety. The present study was designed to determine urinary paraben levels among pregnant women and their matching fetuses, and the association between paraben levels and stress markers. Pregnant women (n=46) and their matching children were recruited from four university hospitals located in Seoul, Ansan and Jeju of Korea, 2011. Parabens including methyl paraben (MP), ethyl paraben (EP), n-propyl paraben (PP), and n-butyl paraben (BP)were measured in urine using an automatic, high throughput online SPE-LC-MS/MS method. Urinary concentrations were normalized with specific gravity. Free cortisol, malondealdehyde (MDA) and 8 -hydroxydeoxyguanosine (8-OHdG) were measured in urine as stress marker and the transcription of NOX1 gene in placenta was quantified using quantitative PCR. Urinary MP was detected as the highest, and BP was detected as the lowest paraben in urine samples of both pregnant women and their fetuses. The levels of urinary parabens among Korean pregnant women are comparable to those reported elsewhere, except for EP which were 4-9 folds higher than pregnant women of other countries. The ratios of fetal to maternal paraben concentrations varied between 0.5 and 0.6 for MP and PP, but approximately 10 fold lower for EP. Urinary MP or EP levels were associated with several oxidative stress related biomarkers such as urinary 8-OHdG and MDA, even after the adjustment of relevant covariates such as maternal age, mode of delivery, pre-pregnancy BMI, gestational age and parity. This is the first study that reported the levels of major parabens in the first urines of newborn infants. Further studies are warranted to understand the implications of paraben exposure among biologically susceptible human populations.

Abstract Number	**P-2-13-22**
Presenter	Hugues Sampasa-Kanyinga, Benoît Lévesque*, Eladhji Anassour-Laouan-Sidi, Suzanne Côté, Bouchra Serhir, Brian J Ward, Michael D. Libman, Michael A Drebot, Momar Ndao, Kay Makowski, Eric Dewailly
Exposure	biomarker
Health domains	infectious diseases
Type of research	cross-sectional study

ZOONOTIC INFECTIONS IN COMMUNITIES OF THE JAMES BAY CREE TERRITORY -– AN OVERVIEW OF SEROPREVALENCE

Background: The Cree communities of James Bay are at risk of contracting infectious diseases conveyed by wildlife. Aims: To present the seroprevalence of different zonotic diseases for the populations of 7 Cree communities of James Bay (Québec, Canada). Methods: Data from serologic testing for a range of zoonotic infections performed in the general population (6 communities), or trappers and their spouses (1 community) was abstracted from 4 population-based studies undertaken in Cree territory (Québec, Canada) during the period 2005-2009. Evidence of exposure to Trichinella sp., Toxoplasma gondii, Toxocara canis, Echinococcus granulosus, Leptospira sp., Coxiella burnetii and Francisella tularensis was verified in all communities, whereas antibodies against Sin Nombre virus and California serogroup viruses (Jamestown Canyon and snowshoe hare viruses) were evaluated in 3 and 6 communities, respectively. Results: Seroprevalence varied widely between communities: Snowshoe hare virus (1-42%), F. tularensis (14-37%), Leptospira sp. (10-27%), Jamestown Canyon virus (9-24%), C. burnetii (0-18%), T. gondii (4-12%), T. canis (0-10%), E. granulosus (0-4%) and Trichinella sp. (0-1%). No subject had serologic evidence of Sin Nombre virus exposure. These data suggest that large proportions of the Cree population have been exposed to at least 1 of the targeted zoonotic agents. However, few related health effects were detected in the medical files of seropositive people. Conclusions: The Cree population, particularly those most heavily exposed to fauna, as well as the medical staff living in these regions, should be aware of these diseases. Greater awareness would not only help to decrease exposures but would also increase the chance of appropriate diagnostic testing.

Abstract Number	**P-2-13-23**
Presenter	Martin Kraft*, Thomas Lahrz, Ludwig Fembacher, Silvio Dietrich, Silvia Sievering, Rainer Burgardt, Gabriele Bolte, Wolfgang Völkel, Hermann Fromme
Exposure	biomarker
Health domains	other
Type of research	exposure measurement

Urinary excretion of phthalate metabolites in 663 children after attendance of daycare centers compared with tolerable daily intake of phthalates

Background In former studies it was hypothesized that high concentrations of phthalates in settled dust of daycare centers are associated with high body burden of phthalate metabolites in children. There is concern about probable health effects among children staying in day care centers with high levels of phthalates in dust. Aims / Methods Urine samples of 663 children (2-6 y) from 63 daycare centers in Germany were collected after they attended the facilities. We analyzed 11 phthalate metabolites in the urine of the children and back-calculated daily intake using medians and 95th percentiles of metabolite concentrations. Additionally we obtained 150 urine samples from a representative subgroup of our collective on Monday mornings at home. Moreover, room air samples and settled dust were analyzed for the presence of 15 phthalate diesters (see also data presented by Fromme et al.). Results Compared with tolerable daily intake (TDI) values recommended by scientific institutions, the share of the high total intake scenario was 72% for DiBP (di-isobutyl phthalate), 58% for DnBP (di-n-butyl phthalate), 31% for DEHP (di-2-ethylhexyl phthalate), and 12% for DiNP (di-isononyl phthalate). For BzBP (benzylbutyl phthalate) and DEP (diethyl phthalate), only 1-2% of the TDI was reached. Some children exceeded the TDI for DiBP (2.7%), DnBP and DEHP (0.2%), DiNP (0.6%) after their stay in the daycare center. For mostly all metabolites the levels in the morning urine samples were higher by a factor between 1.2 and 1.8. Conclusions Based on urinary phthalate metabolite excretion the attendance of children in German day care center is not associated with unhealthy additional phthalate intake. Nevertheless it seems to be necessary to reduce the exposure of children especially to DiBP, DnBP and DEHP. We found no indications that the higher concentrations of phthalates in the dust of daycare centers were a reliable indicator of intake for the children attending these facilities.

Abstract Number	**P-2-14-01**
Presenter	Nils Goeken*, Katja Ickstadt, Martin Schäfer, Hans-Joachim Bücker-Nott, Michael Wilhelm, Jürgen Hölzer
Exposure	drinking water
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Statistical approaches to evaluating the association between mother's exposure to perfluoroalkyl substances (PFASs) and birth outcome in North-Rhine Westphalia

Background: Developmental toxicity of perfluoroalkyl substances (PFASs) has been proven in animal studies. This raises concern over the potential effects of PFAS on human reproductive health. However, results of epidemiologic studies of exposed populations are inconsistent.As reported earlier, more than 4 million residents in several areas of North-Rhine Westphalia (NRW), Germany, have been exposed to PFASs in drinking water. PFASs' concentrations in drinking water were used as a surrogate marker of exposure. Aim: Two statistical approaches (linear regression, spatial Bayesian method) are compared to evaluate the association between mother's exposure to PFASs via drinking water and birth outcome in NRW, Germany. Methods PFASs' drinking water concentrations were derived from an extensive monitoring programme of the North Rhine-Westphalia State Environment Agency. Birth outcome was assessed on the basis of the quality control datasets of the respective Medical Association. For a spatially correlated effect, Markov random field (MRF) priors were chosen, which reflect spatial neighborhood relationships. To estimate the posterior inference the Integrated Nested Laplace Approximation (INLA) was used. Results Drinking water analyses from 33892 measurements provided PFOA-concentrations for 260 water supply areas. PFOA-concentrations ranged from below LOQ to 650 ng/l (37 % > LOQ). Birth outcome, maternal smoking status, medication and other confounders were derived on postcode level for 1,176,488 newborns and their mothers between 2003 and 2010.Matching of birth outcome and PFASs' exposure data was successfully achieved by geoprocessing methods in 382 postcode areas, resulting in a total of 281,019 datasets. Strength of effects and potential confounders will be compared. Conclusion Spatial models might account better for the surrogate drinking water contamination, although MRFs only consider confounders on an aggregate basis. Data will be followed on a longitudinal basis.

Abstract Number	**P-2-17-01**
Presenter	Inge Bos, Patrick De Boever*, Jef Vanparijs, Luc Int Panis, Romain Meeusen
Exposure	ambient air pollution
Health domains	physical activity
Type of research	others

Aerobic training in urban environment: blood gene expression profiling

Background Physical activity is a recommended life-style activity to promote health, while particulate matter (PM) exposure induces adverse health effects. The aim was to investigate the impact of PM exposure during aerobic training on the blood gene expression profile. Methods Healthy, untrained subjects participated in a 12-week aerobic training program (3 sessions/wk), one group (n=15) in an urban location, another group (n=9) in a rural location. Ultrafine particles (UFP) were measured at the training locations during the training sessions. Fitness levels (cooper-test) and whole-genome blood gene expression profiles in blood were determined before and after the program. The up or downregulation of the genes was called significant in case of a multiplicity corrected p-value<0.05 and an effect size in terms of absolute fold change > 1.5. Results UFP concentrations were higher ($p = 0.003$) in the urban location (7240 particles/cc) compared to the rural location (5621 particles/cc). Fitness level improved ($p < 0.0001$) equally in both groups ($p = 0.16$).The expression of 816 genes was altered in the urban group (399 upregulated, 417 downregulated) and 709 genes showed differential expression (665 upregulated, 44 downregulated) in the rural group. The expression of 55 genes of the 254 genes that were altered in both groups were linked to stress response by Gene Ontology. One third of the differentially expressed genes was in common between the groups. The statistical analysis revealed an interaction effect for 246 genes. Thirty nine genes were upregulated and 207 genes were downregulated when the urban group was compared to the rural group. Gene Ontology analysis indicated a significant enrichment for the biological term cell death. No specific terms of genes were discovered that can be associated with immune or inflammatory processes. Conclusions Our study revealed a differential blood gene expression profile with aerobic training in an urban location compared to aerobic training in a rural location.

Abstract Number	**P-2-17-03**
Presenter	Mi-Ae Jeong, Chan Woo Park, Sujin Park*, Jae Jun Kim
Exposure	green spaces
Health domains	mental health
Type of research	exposure measurement

An analysis on the walking effects in the forests between urban forest and national park : focusing on the Mt. Gwanak and Mt. Odae

Background: Many surveys have identified that forest recreation affected human psychological restoration. In these days, inquiries how forest environmental factor affect the psychological restoration have came up. Aims: This study aimed to analyze walking effect between urban forests and national parks. Methods: It investigated at Mt. Gwanak (urban forest) and Mt. Odae (national park) and 10 university students participated in the study. The variation of their profile of mood states (POMS) and the atmosphere environments (air temperature, relative humidity and solar radiation) were analyzed after walking in the forest. Results: The atmosphere environments were different in each forest areas and anion content was the highest at the high altitude of the national park. The POMS measures of tension and anxiety, confusion decreased after the participations walked at Mt. Gwanak. Vigor factor in the POMS increased at Mt. Odae. In addition, the result of correlation between air temperature and psychological factor (depression and confusion) showed that a rise in air temperature brought the result of psychological factor increasing. Conclusions: As the result, it has a possibility that human psychological state would be affected by the region of forest area on difference of environmental factor.

Abstract Number	**P-2-17-04**
Presenter	Honor Bixby, Daniela Fecht*, Lea Fortunato, Susan Hodgson
Exposure	green spaces
Health domains	cardiovascular disease
Type of research	cross-sectional study

Are greener cities healthier? An investigation into the association between green space coverage and health at the city level, in England

Background. Green space has been identified as a modifiable feature of the urban environment that has relevance to the health and wellbeing of residents. Associations between the availability of green space and physiological and psychological health have been found at the ward and neighbourhood levels. Aim. This study aims to assess the association between health and green space at a larger scale, with English cities as the unit of analysis. Methods. An ecological, cross sectional study design was used. Land use within 50 English cities was classified using satellite-based data. This enabled quantification of the proportion of each city's total area covered by green space. Negative binomial regression models were used to assess the association between city green space coverage and the standardized risk of death from all-causes, cardiovascular disease, suicide and lung cancer, with and without adjustment for relevant confounders. Results. No independent association between green space coverage in English cities and risk of death from all-causes, CVD, lung cancer or suicide in men or women was found. Following adjustment for income deprivation, air pollution and population density, the risk of death from all-causes, CVD and lung cancer, for men and women, and suicide for men only, in the greenest cities did not significantly differ from the risk found in the least green cities; the greenest cities had a significantly excess risk of female suicide. Conclusion. These null findings, as opposed to the positive associations found between green space and health outcomes in published studies conducted at smaller area unit levels, suggest the effects of green space may be local. Further work at smaller area level should seek to account for variation in factors excluded from the present study due to the lack of appropriate data, yet likely to influence the use of available green areas, and hence the relationship between green space and health.

Abstract Number	**P-2-17-05**
Presenter	Regina Grazuleviciene*, Asta Danileviciute, Audrius Dedele, Jone Vencloviene, Tomas Grazulevicius, Sandra Andrusaityte
Exposure	green spaces
Health domains	cardiovascular disease
Type of research	cross-sectional study

Association between city parks and risk of hypertension amongst reproductive age women

Background There is some evidence that exposure to green environments is associated with health benefits, including lower blood pressure, although little research has been reported using exposure measures at the personal level. Aims We examined the association between city parks and hypertension amongst reproductive aged women. Methods This study included 3,416 women 20-45 year's old Kaunas city residents. We used a geographic information system (GIS) to assess the ambient NO2 exposure and surrounding greenness in buffers of 300 m, 700 m and 1000 m around each women place of residence. Green space exposure effects on doctor-diagnosed hypertension were estimated by multiple logistic regressions with adjustments for potential confounders and NO2 exposure. Results An increase in the distance from city parks across 20-45 years old women was associated with an increase in odds ratio (OR) for high normal blood pressure group and an exposure-response relation was indicated (OR=1.10, 95% CI 0.80–1.50 and OR=2,01, 95% CI 1.31–3,11, moderate vs. lowest and highest vs. lowest exposure, respectively). The effect was less pronounced amongst women of hypertension group (OR=1.22, 95% CI 0.80–1.86, highest vs. lowest exposure). Conclusions The present study findings suggest a beneficial effect of exposure to green spaces on hypertension risk amongst 20-45 years old women. Neighbourhood greenness may have an impact in prevention hypertension and reducing related morbidity.

Abstract Number	**P-2-17-06**
Presenter	Asta Danileviciute*, Audrius Dedele, Regina Grazuleviciene
Exposure	green spaces
Health domains	reproductive outcomes
Type of research	cohort study

Association between city parks neighbourhood and birth weight

Background: There is some evidence that the urban green space, city parks improve physical and mental health and well-being by increasing physical activity, reducing air pollution, noise, and stress. This evidence to a green space would also be able to affect pregnancy outcomes. Aims: We examined the association between city parks neighbourhood and newborns birth weight. Methods:We conducted a prospective 3416 pregnant women cohort study in Kaunas (Lithuania). We have selected woman who's during pregnancy were exposed to green space during vegetation period at least for 5 moths (1636), and estimated maternal residence distance from green space classified as a Formal park. Women's home locations were mapped using the ArcGIS 10 Geographical Information System (GIS) and combined with a comprehensive GIS database of neighbourhood and green space characteristics. According to the distance from the residents' homes of each respondent to the nearest park, we determined three women groups: residing within 300 m, 300-1000 m and more than 1000 m. The associations between distance from parks and birth weight were analysed by linear regression models with adjustment for body mass index, gestational duration, maternal smoking, education, marital status, parity, and infant sex. We also used the distance from the residents' homes as an exposure continuous variable. Results: Our data shows that newborn who mother resident place was within 300 m from city park mean birth weight was 3454.77±27.14 g, and residence place was >1000 m from city park mean birth weight was 3383.45±37.84 g. Using the distance from the residents' homes as a continuous variable we found slight (2.76 g) but statistically significant (p=0.041) birth weight reduction per every increase in 100 m residential distance from city park. Conclusions: The findings suggest that city park neighbourhood has positive impact on newborns birth weight.

Abstract Number	**P-2-17-07**
Presenter	Erin Bergman*, Kristen C. Malecki, Maggie Grabow, Lynne Morgan, Corinne Engelman, Paul Peppard, Milena Bernardinello, Javier Nieto
Exposure	no exposure
Health domains	physical activity
Type of research	cross-sectional study

Associations between Perceived and Objective Built Environment

Background There is growing evidence to suggest that the built environment has far-reaching impacts on myriad of health outcomes. Differences in associations between perceived and objective measures of the built environment on a variety of outcomes, including physical activity and quality of life, have been demonstrated, suggesting there is value in examining both perceived and objective measures of the built environment. However, few studies have compared perceived and objective measures of the built and social environment. Aims Using presence of non-residential destinations, which has been shown to be predictive of physical activity, this study examines associations between perceived and objective data, as well as demographic and behavioral predictors of discordance between perceived and objectively-assessed measures. Analyses will be stratified by urbanicity to determine potential differences between urban and rural communities. Methods Perceived data were collected using the Survey of the Health of Wisconsin (SHOW) questionnaire on neighborhood environment. Participants (n=1,021) were asked about features of their neighborhood within a 10-minute walk of their house. Objective data was collected using the Wisconsin Assessment of the Social and Built Environment, which assessed street segments in a 400-meter buffer around each SHOW participant's house. Results Overall, there is a relatively high agreement between perceived and objective observations of the built environment (e.g. 72% for presence of a fitness center and 79% for presence of a grocery store). Correlations between perceived and objective assessments vary by item particularly for destinations which have been shown to be most predictive of physical activity. Conclusions Although agreement is good between perceived and objective data on presence of destinations, analysis of predictors of discordance provides useful information for designing studies examining relationships between the built environment and health in the future.

Abstract Number	**P-2-17-08**
Presenter	Sandra Andrusaityte*, Regina Grazuleviciene, Audrius Dedele, Asta Danileviciute, Jolanta Kudzyte, Tomas Grazulevicius
Exposure	green spaces
Health domains	allergies
Type of research	case-control study

City parks neighbourhood and preschool children asthma in the city of Kaunas

Background There is some evidence that access to urban green spaces is associated with a better health; however, the available evidence on the impact of green spaces on children asthma is scarce. Aims We examined the association between residence distance from city parks and preschool children asthma. Methods This study included 536 children 4-5 year's old Kaunas city residents. Doctor's diagnose and symptoms of allergic diseases were assessed by ISAAC-based questionnaires. We used a geographic information system (GIS) to assess the environmental exposures. According to the distance from the residents' homes of each respondent to the nearest park, we determined three children exposure groups: residing within 300 m (referent group), 300-1000 m and more than 1000 m. The associations between distance from parks and prevalence of asthma were analysed by logistic regression models with and without adjustment for maternal education, age, passive smoking, body mass index, parental and other family members asthma, heating system, breast feeding, paracetamol and antibiotic use during first year, and NO2 exposure. Results An increase in the distance from city parks across 4-5 years old children was associated with an increase in odds ratio (OR) for children asthma (referent vs. third exposure group OR=1.41, 95% CI 0.34–5.78) after adjustment for potential confounders. Conclusions The present study findings suggest a beneficial effect of city parks neighbourhood on asthma risk amongst preschool children. Neighbourhood greenness may have an impact in prevalence of asthma and reducing related morbidity.

Abstract Number	**P-2-17-09**
Presenter	Graham Smith, Christopher Gidlow, Hanneke Kruize, Regina Grazuleviciene, Marta Cirach Pradas, Wim Swart, Mark J Nieuwenhuijsen, Gemma Hurst*
Exposure	green spaces
Health domains	other
Type of research	exposure measurement

Classification of natural environments to assess positive health effects of exposure in different regions of Europe

Background: Indications exist that close contact with nature brings benefits to human health and well-being. The PHENOTYPE project will investigate the interconnections between exposure to natural outdoor environments and human health and well-being in North West, South and East Europe. Inconsistency and variation in indicators for green or natural space have often made it difficult to compare results from different studies, and to translate research to better integrate human health needs into land use planning and green space management. Aims: Create a consistent classification of natural environments across partner countries by combining conventional mapping with remote sensing data and aerial photography, and using considerable stakeholder engagement to minimize the potential inconsistencies. Exposure indicators will be linked with participant data to explore health effects of different types of natural environment (in different populations) and underlying mechanisms related to stress reduction/restorative function, physical activity, social interaction/cohesion and exposure to environmental hazards. Methods: The classification of natural environments will be conducted at three levels: 1. Europe-wide, using secondary data and remote sensing analysis. 2. Within participating countries, using locally-held secondary data: a. A metadata collection exercise to identify consistent classifications. b. A review of existing classifications used by stakeholders. c. Derived GIS measures. 3. 'Quality' audit of natural environments (primary data) Results and conclusions: The provisional hierarchical classification of natural environments (both green and blue) comprises four levels of typology, which can be further differentiated by the size, purpose, presence of water and level of access. It can also be combined with 'quality' items derived from a natural space audit tool and existing local data such as traffic, crime and other environment indicators to understand the influence of neighbourhood context.

Abstract Number	**P-2-17-10**
Presenter	Triantafyllos Pliakas*, Cathryn Tonne, Paul Wilkinson
Exposure	green spaces
Health domains	physical activity
Type of research	cross-sectional study

Contribution of the physical environment to socioeconomic gradients in walking in the Whitehall II study

Background: Socioeconomic gradients in walking are well documented, but evidence on the extent to which these may be attributed to the physical environment (PE) is limited. Aims: To examine the contribution of objective measures of PE to socioeconomic gradients in minutes walked per week in participants living in London, UK. Methods: Analysis included 3363 participants (50-74 years) from the Whitehall II study (2002-4) who provided data on self-reported walking, socio-demographic characteristics, and whose postcode of residence could be linked to objective measures of PE. Individual-level socioeconomic position (SEP) was measured as most recent employment grade (six groups). Area-level SEP included quintiles of the income score from the Index of Multiple Deprivation. Attributes of PE included crime, land use, air pollution, road safety, road density, green space, access to services, access to public transport, and population density. Data on walking was log transformed prior to regression modelling. Results: In models adjusted for age, sex, ethnicity and labour market status, average minutes walked were 15.1% (95% CI: 4%-27.5%, p[trend]<0.001) higher in the lowest employment grade compared to the highest. Similarly, adjusted average minutes walked were 12% (95% CI: 2.5%-22.1%, p[trend]=0.041) higher in the lowest quintile of area-level SEP compared to the highest. Objective measures of PE attenuated to some extent the gradient for individual-level SEP (13.8%; 95% CI: 2.6%-26.0%, p[trend]<0.001 for lowest vs highest employment grade) and substantially reduced the area-level SEP gradient in walking (4.6%; 95% CI: -5.9%-16.3%, p[trend]=0.691 for lowest vs highest quintile). Of PE variables, only road safety was found to be predictive of walking. Conclusions: The contribution of PE on individual-level SEP gradients in walking appears to have a small effect in this relatively affluent population of older adults living in greater London. Whether these results are generalizable to the general UK population and outer-London areas requires further research.

Abstract Number	**P-2-17-11**
Presenter	Sonja Kahlmeier*, Thomas Götschi
Exposure	no exposure
Health domains	physical activity
Type of research	others

Economic valuation of health benefits of walking and cycling in Switzerland

Background In Switzerland, only 41% of the population fulfill the national recommendations on physical activity and health. Cycling and walking contribute substantially to total physical activity. Aims To quantify for the first time the economic benefits of health effects from regular cycling and walking in Switzerland and to facilitate integration of health aspects into decision making processes. Methods The WHO's „Health Economic Assessment Tools (HEAT)" for cycling and for walking was applied to data from the Microcensus Traffic to estimate the value of health benefits from reduced mortality with a willingness-to-pay approach. Values associated with current levels of cycling and walking as well as in different scenario analyses were calculated. Results Per-capita health benefits are highest in the German-speaking part of Switzerland, at about CHF 2.800 for walking and about CHF 550 for cycling. Due to lower use of active transport, benefits are about 15% lower for walking and about two thirds lower for cycling in Tessin; the economic benefits found in the French-speaking part lie in between. For cycling, higher benefits were found in the presumably more cycling-friendly cities, while differences for walking were small between cities. A doubling of time spent cycling in Switzerland, meaning rising the national level to that of the most cycling-friendly cities, would result in an economic benefit of about CHF 2 billion per year. Conclusions Economically quantifying the health benefits of active transport for the first time is contributing to a systematic and quantitative assessment of benefits in this area. This study showed that the expected economic effects from increasing active transport are substantial.

Abstract Number	**P-2-17-12**
Presenter	Soo Rim Noh, Wang Lim Lee, Hee Sung Shin, Min Sun Lee, Tae Seon Baek, In Seok Seo, Sujin Park*, Chan Woo Park, Woo-Seok Lee
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	case-control study

Effect of forest bathing on immune function and quality of life in breast cancer patients: a controlled pilot study

Background: The therapeutic effects of forest bathing on cancer patients have not yet been evaluated despite the known beneficial effects of this practice on immune function and stress reduction in healthy human subjects. Aims: . We performed a controlled pilot study to assess the impact of forest bathing in breast cancer patients. Methods: A total of 11 breast cancer patients from an urban area experienced a 14-day/13-night trip to forest areas, and blood was sampled days 7 (the first sampling during the trip) and 14 (the second sampling during the trip), and on days 7 and 14 after the trip. Results: The number of natural killer (NK) cells and the activities of perforin and granzyme were measured. The same measurements were made before the forest trip as a control. The quality of life of the patients was analyzed using the World Health Organization Quality of Life Assessment Instrument-Brief Form (WHOQOL-BREF) before and after the forest trip. The number of NK cells on the forest bathing day 14 was significantly higher than that on the control day and lasted for more than 14 days after the trip. The increased perforin and granzyme activities also lasted more than 14 days after the trip, suggesting that a forest bathing trip would enable cancer patients to maintain a higher level of immune protein activity. Scores of WHOQOL-BREF total and overall quality of life increased significantly after the forest trip compared with the control day. These findings indicate that forest bathing improved the immune function and quality of life of the breast cancer patients, and the beneficial effects on the immune function lasted by 14 days after the forest bathing trip. Conclusions: Therefore, forest bathing should be considered as one of the complementary and alternative medicine options for treating breast cancer patients.

Abstract Number	**P-2-17-13**
Presenter	Ikuko Bamba*, Kenichi Azuma, Saeko Fujita, Yoshio Tsujino, Michiko Uebori, Akitaka Kimura, Masashi Nakamura, Katsuyasu Kouda, Shuichi Kawai
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	case-control study

Effect of Japanese Cedar on Psychological and Physiological Factors Influencing Fatigue Recovery in an Indoor Environment

Background: In Japan, forest resources have not been used effectively, and much lumber from thinning has been left unused for a long time. These days, forest improvement has been reconsidered such that more wood will be used in public buildings and living spaces in Japan. Moreover, the arousing and/or sedative effects of fragrance from wood extracts have attracted increasing attention. Aims: This study was made to investigate how fatigue recovery can be psychologically and physiologically affected by the presence and emissions of cedar in an indoor environment. Methods: We carried out an experiment in November 2011. We assigned 15 healthy subjects (mean age 23 ± 3.8 years) to three groups. The crossover method was used in the experiment. In condition 1, room walls were covered with Japanese cedar, which was visually accessible to the subjects. In condition 2, a room was connected to the aforementioned room, allowing the circulation of air from it; hence, subjects were exposed to emissions from the cedar but could not see it. In condition 3, there was no circulation of air from the previous two rooms, and subjects could not see the cedar. The cedar, which was about 70 years old and grown in Kumamoto prefecture, was dried at 45°C before it was used for construction. Subjects moved to the rooms after spending two periods of 15 minutes each in a preparation room, and stayed in their rooms for 60 minutes. Results: Odor intensity in condition 1 and 2 was significantly higher than condition 3. Cedrol and β-eudesmol was specifically detected in condition 1 and 2 through an analysis of indoor air quality. Their fatigue and scores on the Total Mood Disturbance subscale of the Profile of Mood States decreased the fastest in Condition 1. This result indicates the effect of the odor and appearance of cedar. Physiological responses did not significantly differ between groups. Conclusions: These findings suggest that cedar has a larger psychological than physiological effect.

Abstract Number	**P-2-17-14**
Presenter	Weilin Cui*, Qin Ouyang, Yingxin Zhu, Songtao Hu
Exposure	others
Health domains	physical activity
Type of research	exposure measurement

Effect of low pressure environment on human thermal sensation and physiological parameters in aircraft cabin

Effect of low pressure environment on human thermal sensation and physiological parameters in aircraft cabin Weilin Cui1, Qin Ouyang1, Yingxin Zhu1, Songtao Hu2 1Department of Building Science, Tsinghua University, Beijing 100084, China 2Department of Environment and municipal engineering, Qingdao Technological University, Qingdao 266033, China Abstract The aircraft cabin is designed to maintain an air pressure equivalent to the pressure at 2500 m above sea level (around 75 kPa). The influence of parameters such as air temperature, humidity and air quality on human comfort and health has been investigated by researchers. Little information is available concerning the low pressure environment. The aim of this study is to investigate the influence of the low pressure environment in aircraft cabin on passengers' comfort and health. The experiment was conducted in a simulated low pressure environment lab and six conditions were designed including two temperature levels (25℃, 19℃) and three pressure levels (100kPa, 90kPa, 80kPa). 30 subjects (20 males, 10 females, college students) were recruited. Subjects stayed in low pressure environment for about 90 minutes during which their thermal sensation and physiological parameters like skin temperature, heart rate, respiratory quotient (RQ) and metabolic rate were measured. The results indicated that thermal sensation was lower when pressure was lower which meant subjects felt colder. The same trend was observed for skin temperature. Heart rate increased when pressure decreased and when temperature was lower heart rate was also slower. The influence on RQ was more significant. RQ decreased rapidly as pressure went down but change in ventilation volume was not significant. Metabolic rate was higher at 19℃ than 25℃ because body produced more heat under cold environment. Under different pressures, the change in metabolic rate was also not significant. Keywords Low pressure environment, physiological parameters, thermal sensation

Abstract Number	**P-2-17-15**
Presenter	Minlin Zhu*, Qin Ouyang, Yingxin Zhu
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	health impact assessment

Effects of airflow on thermal comfort before sleep onset in a warm and humid climate

Fans are widely used in south-east of China to increase heat loss day and night in summer time. However, all-night rotating speed control system, which can produce sleeping-friendly airflow, has not been proposed under rigorous human experimental results. Sleeping model, nowadays, prevails on the market, are figured out by testing, to be a variant of the simulated natural wind model which is a beta product in the laboratory, thus the so-called sleeping fans are likely to cause rheumatic pan or even temporary paralysis after all-night using. In this study, customs of using fans during the sleep by Chinese people from different regions and ages are collected through an internet survey distributed in the summer time. The results of the survey show the necessity of sleeping-friendly airflow, customary fan displacement and the preference to the fan type, which partly become the fundamental settings of the human experiment. The human experiment in this study is a preliminary exploration of the airflow preference preceding sleep initiation, in which subjects wearing short pyjamas, supine on a bed covered by rattan mat with a towel blanket under the following conditions: (1) air temperature(Ta) 30℃, relative humidity(RH) 60%, and air velocity(V) 0.6m/s, 1.0m/s, 1.5m/s, 2.0m/s. Common protocol of subjective evaluation on the effect of airflow is obtained for all subjects. TSV declines with the increasing of air velocity, and arrives 0.5 when air velocity is around 0.8m/s, 0.2m/s lower than that under upright condition. Nearly all subjects prefer the airflow with a constant air velocity to the simulated natural wind with a changeable air velocity. The draft is mainly from too high air velocity and immobile airflow direction.

Abstract Number	**P-2-17-16**
Presenter	Ilaria Oberti*, Francesca Plantamura
Exposure	others
Health domains	other
Type of research	review

Green Building Ratings for Healthcare: Indoor Environmental Quality and Environmental Impacts

Background The main objective of the hospitals and other healthcare facilities is to dedicate to the patients providing innovative and compassionate cares that meet high standards of quality in a cost-effective manner. Nevertheless, in fulfilling this important mission to care for patients, hospitals have an impact on the natural environment, so that, over the past few years, regulatory agencies have pushed for greater environmental controls within the healthcare setting. From energy conservation to the proper disposal of medical waste and the safe handling of highly potent pharmaceuticals, the hospitals are discovering that close to the brittleness of the patient, they should also take in consideration the fragility of the natural environment and communities around them. Healthcare facilities across the globe are rising to this challenge by raising the indoor environmental quality and identifying and reducing the negative environmental impact of their operations. Aims To appraise through the principal Green Building Evaluation programmes for healthcare the weight of the IEQ parameters, including IAQ, and that of the environmental impacts parameters. Methods A review of Green Building Evaluation programmes intends to highlight the goals, objectives and evaluation criteria for building design and operation; notable programs include: - BREEAM Healthcare - LEED 2009 for Healthcare - Green Guide for Health Care (GGHC) - HQE - Haute Qualité Environnementale - “Etablissements de Santè” (version for Healthcare). Results/Conclusions Results arise from the question: are the tools analyzed suitable to appraise a hospital as “sustainable” (high IEQ and low negative environmental impact) ? Some overall comments on the findings will be provide.

Abstract Number	**P-2-17-17**
Presenter	Wahida Kihal*, Cindy Padilla, Benoît Lalloué, Marcello Gelormini, Denis Zmirou-Navier, Séverine Deguen
Exposure	green spaces
Health domains	reproductive outcomes
Type of research	others

Green space and spatial analysis of social inequalities in infant mortality in France

Background- Few studies considered environmental benefits to explain social health inequalities. Natural environments that contribute to good health might have an effect on socioeconomic health inequalities. In developed countries, the evidence that green spaces have health benefits for urban population is now strong. Recent studies suggest such positive effects on pregnancy outcomes. Aims- To investigate the relationships between green spaces and the spatial distribution of infant mortality taking into account neighborhood deprivation levels. Methods- The study took place in the Lyon metropolitan area, France (1340 155 in 2009). All infant deaths cases aged <1 yearthat occurred between 2000 and 2009 were geocoded at the census block level (n= 715). Each census block was assigned greenness and socioeconomic deprivation levels. Using a spatial–scan statistic, we examined whether there were significant clusters of high risk of infant mortality according to these neighborhood characteristics. Results- Our results highlight that infant mortality is not randomly spatially distributed, with clusters of high riskin the southwest of the Lyon metropolitan area (53 census blocks; RR:1.70; p<0.003). After adjustment on greenness levels and socioeconomic deprivation, this cluster disappears, suggesting that these factors explain in great part the spatial distribution of infant mortality. No interaction was found between the two factors. Conclusions- We propose 3 hypotheticals not exclusive pathways by which green space may have a beneficial effect on adverse pregnancy outcomes: (i) a psychological pathway, (ii) a physiological disruption process and (iii) an environmental pathway. This work adds some evidence to the link between access to green space and pregnancy outcomes but requires further research for confirmation.

Abstract Number	**P-2-17-18**
Presenter	Christopher Gidlow, Marc Jones, Gemma Hurst, Daniel Masterson*
Exposure	green spaces
Health domains	mental health
Type of research	others

Individual responses to natural and urban environments

Background: There is a positive relationship between health and exposure to natural environments, which may be explained by several mechanisms (physical activity, social interaction, stress reduction, attention restoration). Experimental research is broadly supportive of positive psycho-physiological responses to natural (compared with urban) environments. Limitations include robust physiological measures being confined to laboratory studies, and some field-based research comparing responses to 'bad' urban environments with 'good' natural environments. Aims: As part of the PHENOTYPE project, we are comparing the psycho-physiological responses of healthy English adults on exposure to three types of environment: urban, natural-green, natural-green/blue (water). Methods: (i) Environment selection study. Online survey in which respondents rated images of urban, green, green/blue environments that could be used in the field-based study, on a number of scales (e.g., naturalness, pleasantness). Participant responses will be used to: guide selection of urban and natural comparator environments to minimise confounding effects of environmental quality in field-based work; explore the mechanisms underpinning natural environments and positive health outcomes. (ii) Field-based study. Following baseline measures, 40 healthy adults will walk for 30 minutes in each type of environment on three consecutive days, with follow-up measures at 30 and 60 minutes. Robust, validated measures will be used to determine affective, cognitive and physiological responses. Data collection is planned for Apr-Aug 2013. Results and conclusions: Findings from the online survey and preliminary data from the UK fieldwork will be presented. Through systematic environment selection, controlled exposure to environments and robust data collection methods, data will provide ecologically valid insight into within-individual differences in psycho-physiological responses to the three types of environment.

Abstract Number	**P-2-17-19**
Presenter	Laura Jackson*, Jessica Daniel, Betsy McCorkle, Alexandra Sears, Kathleen Bush
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	review

Linking Ecosystem Services and Human Health: The Eco-Health Relationship Browser

Background Ecosystems provide multiple benefits associated with the provision of nature-based goods and services. Many of these ecosystem services have been linked to a range of positive health outcomes through the buffering of pollutants, mitigation of natural hazards, and promotion of healthy behaviors. An emerging body of evidence exists on this topic; however, it has not yet been synthesized in an accessible manner. Aims The objectives of this research were to identify the set of literature related to the linkages between ecosystem services and human health, and to design an interactive, web-based tool (the Browser) to showcase the weight of evidence and make the information accessible to a diverse audience. Methods In order to create The Eco-Health Relationship Browser, a systematic literature review was conducted. The review was an iterative process, completed in four stages, and focused on the associations between ecosystem services and human health. The search was limited to peer-reviewed journal articles published from 1990 to 2012. Articles were screened for relevance and utility in populating sections of the Browser. Articles were assigned to different sections of the Browser depending on where they fit within the framework, and were summarized accordingly. In addition to overall relevance, preference was given to articles with objectively measured variables and quantitative results. Results The literature review identified 344 unique articles; 169 were selected for summary display in the Browser. The Browser is designed for users across disciplines and sectors who are interested in learning more about the complex connections between ecosystem services, green infrastructure, and urban design as they relate to human health. Conclusions The Browser has the potential to increase awareness of the social, ecological, and economic benefits associated with healthy ecosystems and the services they provide, and thus to better guide decisions affecting those ecosystems.

Abstract Number	**P-2-17-20**
Presenter	Christopher Gidlow, Graham Smith, Richard Wilson, Paul Trinder, Gemma Hurst*
Exposure	green spaces
Health domains	cardiovascular disease
Type of research	cross-sectional study

National prescribing data and natural environment exposures in England

Background: Positive relationships between exposure to green space and routine health indicators have been shown for mortality, and morbidity (hospital admissions and self-report). However, exposure measures have often been at large area level and similar relationships have not been explored using the prescription data. Aims: Explore relationship between natural environment and prescriptions for cardiovascular, respiratory and mental health at small area level for England. Methods: Assign prescription data to areas (LSOA pop~1,500). Hospital Episode Statistics (Apr09-Sep12) with patient GP practice and LSOA were used to calculate an allocation weighting for GP-level prescribing data, which was tested using actual GP practice population data for Stoke-on-Trent. Total medication prescribed Nov10-Oct12 for diseases with plausible biological links to green space (cardiovascular, respiratory, mental health) were proportionally assigned to each LSOA in England. National data: Green space exposure was characterised at LSOA-level using GIS to map residential postcode location data and natural environment location data with national coverage. Local data: Green space exposure was characterised at residential address level using more detailed local data, allowing disaggregation by size, type and purpose. Separate regression models will be used to explore the relationship between green space exposure and amount of each medication prescribed (per condition type), controlling for area-level deprivation and other demographic factors. Results and conclusions: Analyses will take place Feb-May 2013. National results will be reported for 32,482 LSOA areas in England. Prescriptions related to cardiovascular (n~579m), respiratory (n~133m) and mental (n~104m) health will be allocated to GP practice catchment areas (n>10,000). We will compare national and local level associations, and compare relationships in similar analyses with mortality and hospital admissions data.

Abstract Number	**P-2-17-21**
Presenter	Perry Hystad, Hugh Davies, Michael Brauer*
Exposure	green spaces
Health domains	reproductive outcomes
Type of research	exposure modeling

Neighborhood Green Space and Pregnancy Outcomes: Disentangling Effects from Air Pollution and Noise Exposures

Background: While growing evidence suggests urban green space may be associated with improved health, few studies have attempted to disentangle the effects of green space from other spatially clustered physical and social factors. Here we examine the correlation between neighborhood green space, and fine-scale exposure to air pollution, noise and area-level socioeconomic status (SES) within a large birth-cohort. Methods: Using linked administrative data, we identified 70,249 singleton births (from 1999–2002) in Vancouver, British Columbia, Canada. Seasonal residential green space was estimated using 30m Normalized Difference Vegetation Index (NDVI) data for 100m buffers around residential postal codes. Residential noise exposure was estimated using CadnaA software with a focus on transportation-related sources. Residential air pollution exposure was assessed using a number of land use regression models, of which nitrogen dioxide (NO2) is presented here. Area-level SES was measured using household median income data at the census dissemination area level. We assessed the correlation between exposure measures for postal codes of all study participants as well as exposure levels stratified by the lowest and highest quartile income areas. Results: The average NDVI value within 100m of the residential postal code of study participants was 0.25, with small season variation between winter (0.17) and summer (0.26) values. Moderate negative correlations were observed between NDVI values and NO2 air pollution (-0.52) and noise (-0.32) levels. For participants living in the lowest income areas, greenness was significantly lower (0.20 vs. 0.29 NDVI units) and NO2 (18.0 vs. 15.3 µg/m3) and noise (65.0 vs. 62.5 dB) significantly higher compared to those living in the highest income areas. Conclusions: Neighborhood green space is moderately correlated with air pollution and noise exposures and all three exposures vary by area-level SES.

Abstract Number	**P-2-17-22**
Presenter	Grabow Maggie*, Kristen C. Malecki, Erin Bergman, Lynne Morgan, Milena Bernardinello, Corinne Engelman, Paul Peppard, Jonathan Patz, F. Javier Nieto
Exposure	others
Health domains	physical activity
Type of research	cross-sectional study

Perceived and Environmental Determinants of Active Transportation Behavior in Wisconsin

Background: In the United States, about 3.5% of commuting trips are taken by foot or bicycle, 5% by public transit, and the remaining 91.5% by motor vehicle. Regular physical activity has been identified as one of the most significant public health issues in the United States, and the global significance of physical activity is increasing as developing countries adapt more Western modes of transportation. Recent evidence suggests that the physical design of the places where people live and work affects overall travel choices and how much commuters utilize active transportation. However, existing evidence offers an unclear picture of what specific neighborhood elements facilitate these modes of transport. Aims: To analyze the association between objective measures of the built environment and active transportation behavior. Also, to concurrently examine the association between people's perceptions of the same built environment and their subsequent propensity to use active transportation. Methods: Analysis of the data from the cross-sectional Wisconsin Assessment of the Social and Built Environment (WASABE), an ancillary study of the Survey of the Health of Wisconsin (SHOW), which assesses attributes of the physical environment surrounding households of 1,029 adult residents living in urban and rural communities. Active transportation behaviors were linked to environmental audit data and other geographic information systems (GIS) data. Results: Perceived presence of a trail for walking or biking ($p>0.015$) and presence of many destinations ($p<0.001$) within walking distance from home were associated with active transportation. Objectively measured bicycle friendliness ($p>0.001$) (presence of a bike lane or road width supportive of bicycles) was also associated with active transportation. Conclusions: Active transportation behaviors are likely associated with people's perceptions of their built environment, but also with the presence of bicycling supportive streets.

Abstract Number	**P-2-17-23**
Presenter	Audrey de Nazelle*, Ariadna Curto, David Donaire-Gonzalez, Michelle A Mendez, Judith Garcia Aymerich, Thomas Cole-Hunter, Michael Jerrett, Daniel Rodriguez, Mark J Nieuwenhuijsen
Exposure	others
Health domains	physical activity
Type of research	cross-sectional study

Potential for increasing health-beneficial participation in cycling for transportation: a "stages of change" perspective on Barcelona's bike sharing program

Background The multiple benefits of active transportation, from non-communicable disease prevention to climate change mitigation, have led to increasing interests in developing multi-disciplinary health impact assessments (HIA) of walking and cycling strategies. However a fundamental uncertainty regarding the effectiveness of policies to change travel and physical activity behaviour remains. Our study aimed to assess the ability of bike sharing programs to facilitate contemplation and change in individuals to begin cycling for travel purposes. Methods Participants living and working or attending school in Barcelona, Spain, were recruited in the street at 40 random locations across the city. In a quasi-case control sampling design, cyclists and non-cyclists (motorists and public transport users) were targeted to account for low cycling prevalence. A questionnaire was designed to assess from a health behaviour theory perspective the "stages of change" for individuals to begin contemplating or taking action to cycle. Respondents were asked if they currently cycled in the city, and if they cycled or at least considered cycling prior to the commencement of Barcelona's bike sharing program "Bicing". Self-reported and objective data on cycling conditions (e.g. bicycle lanes, traffic, air pollution) were also collected. Results Of the 367 current cyclists, nearly two thirds had never or nearly never used a bicycle for their current cycle trips before "Bicing", and 70% had never or nearly never considered cycling. Almost half of all current cyclists would have taken public transportation for the same trip previously, 30% would have walked, and less than 5% would have used a motor vehicle (car or motorcycle). Non-cyclists (n=428) reported being unaffected in their willingness to cycle by the "Bicing" program. Conclusions Bike sharing systems provide an impetus for cycling for transportation. Further analysis will explore built environmental influences on cycling and cycling awareness.

Abstract Number	**P-2-17-24**
Presenter	Magda Cristina Cepeda Gil*, Luis Fernando Gómez Gutierrez, Olga Lucía Gómez Gutierrez, Janeth Mosquera
Exposure	others
Health domains	physical activity
Type of research	cross-sectional study

RELATION OF BUILT URBAN ENVIRONMENT AND WALKING FOR TRANSPORTATION AMONG ADULTS IN CALI-COLOMBIA – MULTILEVEL ANALYSIS

Background Worldwide prevalence of physical inactivity is high. Walking for transportation is a domain of physical activity that contributes to increase it in daily life. Built urban environment attributes have been correlated with its practice, particularly in high-income countries. However, literature is controversial and scarce in low and middle-income countries. Aims The study aimed to evaluate the relationship between built urban environment and walking for transportation among adults in Cali, Colombia. Methods It was a secondary analysis of baseline information based on a multilevel cohort study. In 729 subjects aged between 18-44 years of Cali, were applied surveys about demographic variables and physical activity through long IPAQ questionnaire. Built urban environment variables of the 71 micro-territories generated were measured with GIS, in 3 buffers (500, 750m2, and total residential area). Crude and adjusted OR's were obtained with logistic hierarchical regression for 3 cutoffs of time walking for transportation (≥30, ≥60 and ≥150 minutes per week). The study was approved by the ethics committee at Universidad del Valle. Results For each cutoff, the prevalence was 59%, 46% and 18%, respectively. About 40% were men and half were 30 years (IQR 23-36). After adjusting for individual and contextual variables, walking ≥60min was associated with excellent to good perception of safety in neighborhood (OR=1.6, 95%CI 1.1-2.2). For walking ≥30min, owing motorcycle or car reduced the probability in 40% (95%CI 0.4-0.9), but the highest tertile of trees/hectare index increased it (OR=2.0, 95%CI 1.2-3.4). Marginal negative relationships were found with park area index and points of traffic lesions. Conclusions This study highlights some environment features related to walking for transportation, in the context of a middle-income country, where physical inactivity is a public health problem. More research is necessary to better understand and to intervene physical and social urban environmental determinants of physical activity.

Abstract Number	**P-2-17-25**
Presenter	Sujin Park*, Mi-Ae Jeong, Jeonghee Lee, Chan Woo Park, Jae Jun Kim
Exposure	green spaces
Health domains	mental health
Type of research	case-control study

Short-term effects of walking in the forest

Background: Recently, various studies for positive effects of forest environments to human are ongoing and some of the results are identified the effects. However, most of the studies were only used psychological questionnaires and scientific evidences are still insufficient. Also, were limited to indoor experiments and data inquiries, the necessity of on-site clinical tests are on the rise to investigate actual forest effect to human. Aims: To analyze and compare results from psychological relaxations by using profile of mood state(POMS) and Malondialdehyde(MDA) level as a scale of oxidative damage before and after walking in the forest and on the street. Methods: 29 participations (15 males and 14 females) walked in the forest and on the street for 30 minutes of each for two days. The participations filled a questionnaire for POMS and conducted an oxidative damage test(MDA as biological marker through a urine test) before and after walking. The MDA levels were assorted by color change and a simplicity measurement is used to discriminate it. Results: To compare the psychological states after walking in the two difference places, walking in the forest showed statistically more meaningful results in the section of tension, depression, anger, fatigue, confuse and total mood disturbance($p<0.001$) than walking on the street. According to the MDA results, a concentration of MDA showed significant increase after walking on the street($p=0.014$). On the contrary to this, a concentration of MDA tended to decrease after walking in the forest. Conclusions: This study found significant results through MDA. The study showed that the psychological states were more stable and oxidative damages were more decreasing after walking in the forest than walking on the street. To perform a clinical research through on-site walking experiments is significance; however, a small number of participations and a measurement of short term effect are limitations. An investigation of long term effect with various groups of participations would be needed for future studies.

Abstract Number	**P-2-17-26**
Presenter	Peter James*, Jaime E. Hart, Francine Laden
Exposure	ambient air pollution
Health domains	physical activity
Type of research	exposure modeling

The association between walkability and particulate air pollution

Background: One study in Vancouver has demonstrated a relationship between air pollution and neighborhood walkability measures, such as land-use mix, street connectivity, and residential density. If these two factors are related, then beneficial impacts of walkable neighborhoods on chronic disease may be attenuated by air pollution exposure. Aims: To investigate the relationship between walkability and air pollution in a nationwide cohort across the United States. Methods: We used data from 2006 from the Nurses' Health Study, a nationwide prospective cohort of female nurses. Using Census and geographic information systems (GIS) data, we created measures of residential density, business counts (as a proxy for land use mix), and intersection counts (as a proxy for street connectivity) based on 1200m line-based network buffers around the mailing address of each participant. We modeled air pollution exposure using a GIS-based spatiotemporal generalized additive mixed model that predicts monthly concentrations of PM2.5 at each participant's address. We conducted linear regression looking at the relationship between walkability measures and PM2.5. Results: There were 61,264 addresses with data eligible for analysis. Mean levels of PM2.5 were 10.7 (standard deviation 2.2) µg/m3. After adjustment for census tract median income and household value, the highest tertile of intersection count, business count, and population density was associated with a 1.21 (95% confidence interval 1.17, 1.25), 1.34 (1.30, 1.38), and 1.86 (1.82, 1.90) µg/m3 higher level of PM2.5, respectively. Conclusions: There was a positive relationship between walkability measures and modeled air pollution levels.

Abstract Number	**P-2-17-27**
Presenter	Kazuhiko Ito*, Kate Weinberger, Perry Sheffield, Ramona Lall, Guy Robinson, Patrick Kinney, Thomas Matte
Exposure	green spaces
Health domains	allergies
Type of research	time series study

The associations between daily spring pollen counts and asthma emergency department visits syndrome in New York City

Background: Some pollen genera trigger seasonal allergic illness, but their population-level impacts on respiratory morbidity are not well established. Previously, we reported an association between pollen and over-the-counter allergy medication sales (OTCAMS) in New York City (NYC). Aims: To determine the relationship between daily pollen counts and asthma emergency department (ED) visits based on patients' chief complaints ("asthma ED syndrome") reported electronically to the NYC Department of Health. Methods: Nine clinically-relevant spring (March-May) pollen types measured in Armonk, NY, were analyzed for their associations with daily asthma ED syndrome during 2002-2009 in all-age and age groups. We also examined three factor analysis-derived pollen factors, corresponding to early (associated with Ulmus, Populus, and Acer), middle (Acer, Betula, Fagus, Quercus, Fraxinus, and Platanus), and late (Carya and Quercus) spring. Rate ratio (RR) and its 95 percent confidence intervals of multi-day impacts on asthma ED syndrome from the highest peak of each of log-transformed pollen types were estimated using a distributed lag Poisson model adjusting for seasonal trends, year, day-of-week, temperature, and humidity. Results: Associations between pollen and asthma ED syndrome were found at longer lags (0-7 days) than those found for OTCAMS (0-3 days). Platanaus showed the strongest association with asthma ED syndrome, with a cumulative RR of 1.79 (1.58, 2.02), followed by Fraxinus and Fagus. The mid-spring tree pollen factor was most strongly associated (cumulative RR of 1.60 (1.44, 1.78)). Associations were stronger in children (age 5 -12) through young adults (age 18-39). Populus and Ulmus were not associated with the outcome. Conclusions: Tree pollen types peaking in mid spring exhibit substantive impacts on asthma ED visits. Public health and clinical approaches to anticipate and reduce asthma morbidity from spring pollen should be developed and evaluated.

Abstract Number	**P-2-17-28**
Presenter	Sung chul Seo, Young Yoo, Sujin Park*, Chan Woo Park
Exposure	green spaces
Health domains	allergies
Type of research	health impact assessment

The clinical effects of forest camp on children with allergic diseases

Backgroud&Aims: This study aimed to investigate the clinical effects of forest camp on chronic allergic diseases in childhood, by comparing changes in symptoms, psychological stability, awareness about the disease, and immunological changes before and after the forest camp which mainly consists of medical tests and activities such as rehabilitation, education, and recreation. Methods: A total of 48 children with physician-diagnosed for asthma or atopic dermatitis were enrolled in the study. The forest camps were held twice in the summer, 2012. The patients' conditions were evaluated before the camp, and skin prick tests were performed. Clinical improvements were evaluated by spirometry and the fractional exhaled nitric oxide (FeNO) for asthma patients and by SCORAD and tests of chemokine levels from blood samples for atopic dermatitis patients, respectively. Results: At the asthma camp, 21children participated (14 boys/ 7 girls, mean age 10.2 years), at the atopic dermatitis camp, 27 children (8 boys/ 19 girls). House dust mite was the most predominant allergen for all patients in both camps. The significant decreases for the concentrations of FeNO used as an indirect airway inflammation parameter for asthma patients were observed after the forest camp ($P<0.05$). Results of spirometry were also shown in an increasing trend, but were without significance. The SCORAD indices decreased significantly after the forest camp ($P<0.01$), and further decreasing levels of TARC(CCL17) and MDC (CCL22) used as immunological parameters were also seen after the forest camp. However, TARC (CCL17) results showed no significance. Conclusions: Children with allergic diseases who participated in this forest camps showed an improvement of their symptoms, comparing results before and after the camp. These results indicate that the forest environment may play an important role in the improvement of allergic diseases in childhood, and the forest camp may be promising tool for enhancing exposure to forest environment.

Abstract Number	**P-2-17-29**
Presenter	Jolanta Stasionyte, Jone Vencloviene*, Audrius Dedele, Raimondas Kubilius
Exposure	green spaces
Health domains	cardiovascular disease
Type of research	case-crossover study

The effect of urban green space on the risk of coronary events within one year in patients with acute coronary syndromes

Background and Aims: There is evidence that exposure to green environments is associated with health benefits. The aim of this study was to investigate relationship between urban green space (UGS) and coronary events (CE) in one year period after hospital admission in patients with acute coronary syndromes (ACS). Methods: We used data of 1,022 patient's who lived in Kaunas and were treated for ACS in Hospital of Lithuanian University of Health Sciences during 2004-2005 and survived more than 14 days.Patient's home locations were mapped using the ArcGIS 9.2 Geographical Information System (GIS) and combined with a comprehensive GIS database of urban green space and main street characteristics. We estimated patients residence distance from UGS classified as a Formal park and main street.According to the distance from the residents' homes to the main street and green space we determined three patient's groups by tertiles. The associations between distance from UGSand the risk of CE were analyzed by multivariate logistic regression, adjusting for patient's age, prior peripheral artery disease and stroke,pulmonary hypertension, low high density lipoprotein cholesterol, coronary artery stenosis, heart rate, ejection fraction, myocardial revascularization), and patients residence distance from main street. Results:The adjusted odds ratios (95% CI) for CE in patients, survived > 60 days after hospitalization, residing close to 350 m, within 350-700 m, and further 700 mfrom park were, respectively, 1, 1.23 (0.56-2.72), 2.33 (1.11-4.92). An UGS distance rise of 100 m was associated with an increase of CE risk by 1.06 (1.01-1.12). We found stronger associations between home distance to thepark and CE for men: the adjusted odds ratios were 1, 2.02 (0.67-6.10), 4.19 (1.46-12.0). Conclusion: Living close to urban green space was associated with lower risk of coronary events in one year period in patients with ACS; the risk was higher for men.

Abstract Number	**P-2-17-30**
Presenter	Chien-Yuan Huang*, Yun-Ya Fang
Exposure	no exposure
Health domains	obesity
Type of research	cross-sectional study

The effectiveness of aerobic exercise intervention on physiological parameters and quality of life

Background: The workload, independent ability, environmental adaptation, work competitive increase pressure in workplace. "Karoshi" (death from overwork) may lead to sudden death. Therefore, it is very important to have healthy body and cultivate good lifestyle in the workplace for health promotion. Aim: This study aimed to investigate the effects of aerobic exercise on related physical parameters and quality of life among employees in the high-tech industries in southern Taiwan. Methods: A total of 75 employees were recruited in this study. They were randomly assigned to either experimental group (n=37) or control group (n=38). The aerobic exercise was used as intervention program in this study. Participants in the experimental group received 12 sessions (30 minutes /a session/ per week) of aerobic exercise. Participants in the control group received no intervention. The research instruments included physiological status, blood biochemical, fitness cases indices, quality of life, working pressure and job satisfaction. Results: The experimental groups' body weight, BMI, waist, and cholesterol, triglycerides, high-density lipoprotein, low-density lipoprotein were significantly decreased than control group by pair t-test ($p<0.05$). Fitness comprised muscle endurance, flexibility, cardio- respiratory endurance were significantly different ($p<0.05$). Quality of life, job control, interpersonal relationship in the workplace and job satisfaction showed significantly increased in the experimental group ($p<0.05$) compared with the control group. Conclusion: This study suggests that aerobic exercise has effects to the weight loss, relaxation, promotion of the negative impacts of work stress; thus, enhance the physical health, job satisfaction and quality of life.

Abstract Number	**P-2-17-31**
Presenter	Feng-Chi Liao*, Ming-Jen Cheng, Reuy-Lung Hwang, Wen-Shan Yang
Exposure	green spaces
Health domains	other
Type of research	others

The influence of urban land cover and land use on local climate in Taiwan

The global warming has become worse with the industry developing and environment destroyed. Because of problems on highly land developed, natural environment changed, and other artificial heat influences, it causes that urban heat island effect in the urban region with highly intensive population and makes the living environment worse at the same time. Finally, we mainly investigate the influence of land use on urban microclimate and provide some strategies of mitigating the urban temperature increasing. In the study, we divided the land use patterns around each measured location into five categories: the building area, the paved area, the free area, the green area, the waters area, and we established 24 different measuring points in Taichung, Taiwan (120°40'E, 24°08'N) in the summer of 2008 and 2009 with the long-term air temperature and the humidity fixed-point monitoring. After the land use pattern factors was quantified with buffering analysis, the association analysis were made by ANOVA and multiple regression analysis, regarding the minimum, average and maximum temperature data obtained climatic monitoring for each location. Finally, we established five divinable air temperature equations and the results shows that it will create 0.6~3.8℃ daily temperature differences around the different proportion of urban land use patterns in the same instrument mounted situation. Besides, the temperature will decrease 0.6~2.6℃ with the factor in green area and increase 1.8~3.8℃ with the factor in pavement area. In conclusion, we forecast microclimate variation by the urban land-use plan, and propose four aspects of strategies: urban development strength controlling, trees planting increasingly, permeable pavement building, and urban water landscape creating, in order to be the reference of improving the urban micro-climate and building a suitable outdoor thermal environment for health.

Abstract Number	**P-2-17-32**
Presenter	Katarina Ana Lestan*, Ivan Eržen, Mojca Golobic
Exposure	green spaces
Health domains	healthrelated quality of life
Type of research	cross-sectional study

The role of urban green areas for quality of life

This paper presents the issues of residential areas dating from the time of political and economic changes in the early nineties and the transition to a market economy in Ljubljana, Slovenia. The main focus are the new urban residential developments, since compared to the older neighbourhoods, the newer ones are typically single-use residential, while their open spaces are reduced in size and programme. Key research problem deals with the quality of life (QOL) in these areas, measured especially in the context of needs of the most vulnerable users, like the elderly and children. Both depend on well accessible green areas in near proximity to their homes. This paper explores how the residents experience the new spatial organisation of their living environment, and how the poor quality open spaces may affect their behavioural patterns, which in the end influences their health status. A lack of appropriate accessible open green areas results in spending the majority of time indoors. The indoor air is known to be polluted with several chemicals, nano-particles, microorganisms, electrosmog etc. Spending time indoors should therefore be balanced with the time spent outside. The research has three methodological phases: 1. a comparison between urban residential areas by selected criteria and indicators of QOL, 2. behaviour mapping and 3. interviewing of residents. The 1.phase confirms differences between open spaces of the selected residential areas: in comparison with older neighborhoods newer are denser and have less potential for spending time outside while being inhabited by more children. The second phase, observation and behavioral mapping, results in identification of outdoor activities: a lack of outdoor programs increases transition activities. The interviewing process, which is determined on the basis of CHMS (CINDI Health Monitor Survey), involves the actual inhabitants of settlements, providing their personal view of their home environment and behavioral style.

Abstract Number	**P-2-17-33**
Presenter	Genaro Gallegos*, Martha Georgina Orozco Medina
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Urban forest health diagnosis in critical areas by air pollution in the metropolitan area of Guadalajara, Jalisco

BACKGROUND. The present levels of air pollution in large cities are a problem that affects not only people, but also to vegetation. Species are more resistant than others to air pollutants, which do not always correspond with the native species. The genus Fraxinus is clearly identified as sensitive to ozone, especially some species such as F. americana, without the use of any studies in the species F. uhdei yet, which is native to Jalisco and one of the most used in urban forestry plans. OBJECTIVE: To conduct an assessment of the health status of the species Fraxinus uhdei in Guadalajara Metropolitan Area in relation to levels of air pollution. METHODS: Inspection leaf of F. uhdei individuals in four parks near stations monitoring air quality with 30 individuals each, compaction of soil, rainfall, temperature, passive monitors ozone, sulfur dioxide, oxides of nitrogen. Correlation with ozone levels information, PM10, SO2, NOx from Air Quality Monitoring Network of the State of Jalisco. Comparison with control area. RESULTS: There was chlorosis, necrosis, stained abnormally, fungi, mistletoe at individuals in every 4 of the study parks, unlike the control zone. CONCLUSION: High levels of ozone, PM10, SO2, NOx affect the health of the species F. uhdei trees in the study areas.

Abstract Number	**P-2-18-01**
Presenter	Harish C. Phuleria*, Siventher Jeyachchandren, Elisabetta Corradi, Harald Zechmeister, Nino Kuenzli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

ASSESSMENT OF LONG-TERM SPATIAL VARIATION OF HEAVY METALS AND POLYCYCLIC AROMATIC HYDROCARBONS IN URBAN AREAS OF BASEL

Background:Most existing studies relied on measurements of particulate chemical constituents such as metals and polycyclic aromatic hydrocarbons (PAHs) at a few locations only. Assessment of long-term spatial variation of exposure to these hazardous air pollutants (HAP) within urban area thus poses a primary challenge. This study presents a new cost-effective and maintenance-free approach to monitor HAPs using moss as biomonitors. Aims: Primary aims were to assess the within-city spatial variation of heavy metals and PAHs and their determinants in Basel and compare them against corresponding standard gravimetric PM10 (particulate matter mass <10mm diameter) based methods. Methods: We conducted 2-week as well as 2-month monitoring of heavy metals and PAHs using moss bags (Hylocomium splendens) at 20 residential outdoor locations in Basel in spring and summer 2011. Concurrently, PM10 was also measured at the same locations. Collected moss and PM10 samples were analyzed for 13 heavy metals and 12 PAHs (>4-ring) using standard ICP-SFMS and GC-MS methods, respectively. Comparisons between seasons, different exposure windows and the two methods are made. Univariate as well as multivariate linear regressions are performed to find the determinants of spatial variation of these HAPs. Results: Long-term moss samples (2-month) have an order of magnitude higher levels than biweekly samples for heavy metals (435+ 370 vs 58.1+37.9 micrg/kg moss) as well as PAHs (23.6+27.4 vs 4.9+2.2 micrg/kg moss); biweekly spring samples were higher than summer for most metals and PAHs. Sn, Sb, Mo, Ni showed a highly correlated cluster (R>0.95) implying their common origin from traffic sources. All PAHs and Sb, Ni and Mo are higher at traffic impacted sites than urban background sites. Comparison of these HAPs between moss and PM10 as well as their spatial determinants is currently underway. Conclusions: Our first results suggest traffic as the main driver of hazardous air pollutants' variability in Basel.

Abstract Number	**P-2-18-02**
Presenter	Simone Takeda, Rubia Kuno*, Nelson Gouveia
Exposure	metals
Health domains	no health domain
Type of research	cross-sectional study

BLOOD LEAD AND MERCURY LEVELS IN CHILDBEARING-AGED WOMEN IN THE METROPOLITAN AREA OF SAO PAULO

Background and aims: Exposure to methyl mercury and lead is a risk factor for neurodevelopment toxicity as these contaminants can cross the placenta. We assessed blood mercury and lead levels in childbearing-aged women and explored possible associations with socioeconomic characteristics and lifestyle factors. Methods: We analyzed data from a cross-sectional study conducted in the metropolitan area of Sao Paulo (MASP) in 2009. Results: 126 women, aged 18 – 49 years old (mean 31.5) were included in this study. The geometric means (µg/L) of mercury and lead were 1.44 and 17.57, respectively. Blood mercury levels ≥ 5.0 µg/L was found in 12.7% of women. Results of multiple linear regression analyses for mercury revealed that fish consumption frequency significantly contributed to mercury blood levels in these women. Women who consumed fish one or more times per month present 80% higher blood mercury level than women who didn't consume fish or consumed less than once a month. Blood lead levels ≥ 50.0 µg/L was found in 1.6% of women. Factors associated with higher blood lead levels in these women included income (women with income lower than BRL$ 1550 exhibited approximately 31% more lead) and smoke habit (smokers presented approximately 24% higher lead in their blood than nonsmokers). Conclusion: Overall, women of childbearing age in MASP present low lead concentration in blood and relatively higher mercury levels. Higher blood lead concentration is associated with socioeconomic factors. Fish consumption frequency is the main determinant to high levels of mercury in blood. Further studies are necessary to assess the risk of consumption of different species of fish by women of childbearing age and pregnant women.

Abstract Number	**P-2-18-03**
Presenter	Sung Kyun Park*, Debra Schaumberg, Marc G Weisskopf, Howard Hu, Susan A. Korrick
Exposure	metals
Health domains	neurodegeneration
Type of research	cohort study

Cumulative Lead Exposure and Age-Related Cataract in Middle-Aged and Elderly Women

Background: Age-related cataract is the leading cause of blindness and visual impairment worldwide, accounting for more than 40% of global blindness. Lead has been proposed as a potentially important risk factor. Possible mechanisms include lead-induced changes in the lens through redox status, glutathione metabolism, lipid peroxidation, post-translational protein modification, and calcium homeostasis. However, only one epidemiologic study has examined the association between cumulative lead exposure and age-related cataract and it was limited to men. Aim: We examined the association of cumulative lead exposure with the risk of age-related cataract in middle-aged and elderly women. Methods: Participants were 502 Boston area participants in the Nurses' Health Study (mean age=63 yrs, range 55-74 yrs) who had lead exposure assessments done in two substudies (bone lead measured in 1993-1995 and 2001-2004), had cataract extraction from 5 years before the bone lead measurement to 2008, and whose cataracts were not congenital or secondary to chronic steroid use, previous intraocular surgery or ocular trauma. We identified cases of cataract extraction by a biennial questionnaire and confirmed all cases with review of medical records. Bone lead levels were measured by K-x-ray fluorescence. We used logistic regression to compute the odds ratio (OR) and 95% confidence interval (CI) for an interquartile range (IQR) increase in bone lead. Results: We identified 48 cases (9.6%) of cataract extraction. After controlling for substudy, age, smoking, and body mass index, neither bone lead measure was associated with cataract (OR=0.80 (95% CI, 0.51, 1.24) for tibia lead (IQR=11 µg/g); OR=0.98 (95% CI, 0.62, 1.53) for patella lead (IQR=13 µg/g). Conclusions: The present study does not support the hypothesis that cumulative lead exposure increases the risk of age-related cataract in women, but further research in larger populations is needed.

Abstract Number	**P-2-18-04**
Presenter	Minsang Yoo*, Soo-Hun Cho, Moyeol Kang, Yun Chul Hong
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Dietary factors affecting blood cadmium level in Korean adults.

Background Dietary intake is a major route of cadmium exposure to human. It is well known East Asians including Korean and Japanese have higher blood cadmium levels than other regions. Aims We investigated dietary factors affecting blood cadmium levels in adults. Methods This cross-sectional study evaluated adult participants from the Korean National Health and Nutrition Examination Survey for 2008–2010. Food frequency record was categorized into 4 groups; rarely consumption, 1/month, 2~3/month, more frequent than 1/week. A geometric mean of blood cadmium was calculated adjusting for demographic and life style factors. To characterize food groups, we performed factor analysis from food intake variables. We conducted multiple linear regression to investigate the association between blood cadmium level and food groups adjusting for demographic and life style factors. Results In this analysis, the total subjects were 5,028. As more frequent consumption of food including shellfishes, yellow corvina, pollack, Soju, rice wine, etc., blood cadmium level was increased significantly. In contrast, consumption of some foods including meats, bread, noodles, strawberries, and banana etc., was negatively associated with blood cadmium level. We classified food variables into 3 groups by factor analysis; 'Western and fast-food diet', 'Korean traditional diet', and 'Fruit and fiber-rich diet'. Multiple linear regression analysis showed 'Western and fast-food diet' and 'Fruit and fiber-rich diet' were negatively associated with blood cadmium level, whereas 'Korean traditional diet' had positive association with blood cadmium level (Western and fast-food diet, beta=-0.069, P-value<0.0001; Fruit and fiber-rich diet, beta=-0.0299, P-value=0.0002; Korean traditional diet, beta=0.0393, P-value<0.0001). Conclusions Korean traditional diet was positively associated with blood cadmium level. Rice meals as well as other Korean traditional food items may contribute to high level of blood cadmium.

Abstract Number	**P-2-18-05**
Presenter	Siying Huang*, Howard Hu, Brisa N. Sánchez, David C. Bellinger, Karen E. Peterson, Adrienne Ettinger, Héctor Lamadrid-Figueroa, Lourdes Schnaas, Adriana Mercado-García, Mauricio Hernández-Avila
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cohort study

Effect of Timing of Lead Exposure in Early Life on Childhood Neurobehavioral Outcomes

Background: The impact of lead exposure on neurobehavioral development remains unclear with regard to critical windows of exposure in early life. Aims: The aim of this study was to compare the relative impact of lead exposure at different time periods of early life, childhood and adolescence on measures of behavioral performance. Method: Data from 583 mother-infant pairs with births between 1997 and 2001 in Mexico City was used for this analysis. Prenatal lead exposure was estimated from maternal blood collected at each trimester and from cord blood at delivery. Postnatal exposures were assessed in offspring's blood every 6 months in the first four years post-delivery and at the behavioral tests when children were 6 to 13 years of age. Behavioral outcomes were assessed with Behavioral Assessment System for Children 2, Conners' Rating Scales and Conners' ADHD/DSM-IV Scales. Linear regression was used to assess the relationships between lead exposures and behavioral outcomes. Results: Cumulative/integrated maternal gestational blood lead measures had mean±SD values of 3.37±1.88 µg/dL. Cord blood lead level was 4.99±3.28µg/dL. Children's cumulative/integrated blood lead level from the first two years was 9.01±5.27µg/dL and from the second two years was 12.06±4.73 µg/dL and was 2.97±2.07 µg/dL at the time of behavioral testing. Cord blood lead was a strong predictor for greater perfectionist behavior. Cumulative blood lead in the 3rd and 4th years post-delivery significantly predicted greater inattention/hyperactivity behavior. Compared to blood lead later in childhood, blood lead prenatally and in the first two years of life had a greater adverse impact on standardized effect estimates of behavioral outcomes. Conclusion: Lead exposures during the prenatal period and in the first two years of life have strong and long-lasting impacts on behavioral problems in childhood/ early adolescence.

Abstract Number	**P-2-18-06**
Presenter	Nisha Naicker*, Angela Mathee, Brendon Barnes
Exposure	metals
Health domains	policy
Type of research	cross-sectional study

Environmental lead exposure- a public health challenge in urban South Africa

Background Exposure to environmental lead remains a major public health challenge. Aim In 2002 and 2007 cross-sectional surveys assessing lead exposure were conducted in grade 1 children in three cities (Kimberley, Cape Town and Johannesburg) in South Africa to assess the trends of blood lead distributions in children. Methods Finger prick blood tests were conducted using the LeadCare 1 analyser system. Questionnaire data assessed risk factors and demographic data. Blood lead levels was dichotomised at 5 µg/dl, based on the CDC recommendation. Results A total of 1349 grade 1 students (51% males and 49% females) participated in the survey. The mean age was 7.62 years. The majority of the households were impoverished with 33% earning less than R1000 (USD 125) per month. The mean blood lead level in the total sample was 7.97 µg/dl, ranging from 0.8 to 32.3 µg/dl.74% of the sample had blood lead levels ≥5 µg/dl and 25% had levels >10 µg/dl. The Johannesburg sample had the highest proportion (84%) of children with blood lead levels ≥ 5 µg/dl, while in Kimberley 57% and in Cape Town, 66% were similarly affected. In the 2002 survey 35% of children in the same schools in Johannesburg had blood lead levels of > 10ug/dl compared to 33% in this survey.However in Cape Town and in Kimberley in 2002 10% of children in the same schools had blood lead levels > 10 µg/dl compared to 18% and 13% respectively in 2007.Five years later there has been an 8% and 3% increase in blood lead levels in Cape Town and Kimberley, indicating that there are pockets of children in urban South Africa who continue to be at risk. Conclusion This study has highlighted that children's blood lead levels are still too high and in some areas the proportion of children with very high blood lead levels ≥ 10 µg/dl has been rising. Thus it is imperative that a national surveillance network be developed to identify high risk groups, services and products as well scale up public education programmes.

Abstract Number	**P-2-18-07**
Presenter	Ravi Sharma*, Evelyn Talbott, Luann Brink, Gary Marsh, Stacey Benson, Wen Chi Wu
Exposure	metals
Health domains	neurodegeneration
Type of research	case-control study

Geospatial Modeling of Elevated Blood Lead Levels in Children

Background: Low level lead exposure can adversely affect IQ and behavior. Although blood lead levels (BLL) in US children have dramatically declined over the past 40 years with the removal of lead from paint and gasoline, lead used in industrial activities may become part of our outdoor environment and may be a significant contributor to BLL. Methods: Kansas provided geographical coordinates (X,Y), and demographic data on 41,228 children less than 36 months who were tested for BLL between 2000-2005. We investigated the ratio of cases:controls (BLL > 10) on a grid using kernel density. Next we applied a binary regression using a Generalized Additive Model (GAM). The residual spatial variation was modeled by including a smooth spatial function. Lead exposure was estimated as the inverse distance between each residence and the nearest Toxic Release Inventory (TRI) site with lead emissions. Results: Based upon a bandwidth of 0.2, the kernel density (ratio of cases:controls) varies across space. The probability of being a case in each kernel varies from 0.0 to 0.2, depending on geographic location, and was associated with proximity to lead industry, after controlling for the individual-level covariates gender and age and census level covariates poverty and older housing. Conclusions: Findings indicate considerable regional differences in EBLL. Non Residential environmental sources of lead appear to continue to play an important role in the risk of BLL for children.

Abstract Number	**P-2-18-08**
Presenter	Jennifer Mall*, Martha Berger, Devon Payne-Sturges
Exposure	metals
Health domains	policy
Type of research	review

Investigation of Trends in Lead Contacts Amongst the US Pediatric Environmental Health Specialty Units (PEHSU) Network

Background: The Pediatric Environmental Health Specialty Units (PEHSU's) were created in 1998 by US EPA and ATSDR. In the early 1990's, two widespread incidents occurred in which environmental toxicants went largely undetected by local clinicians. The PEHSU program was born out of this critical need for environmental health expertise. Currently, there are 12 regional US PEHSU sites, each affiliated with an academic center and include an environmental medicine physician and pediatrician. The mission of the PEHSU program is to consult with patients or other clinicians on environmental hazards, provide referrals and build capacity by educating medical providers on children's environmental health. PEHSU's can be contacted by clinicians, nurses, public health practitioners, school officials, media representatives, parents or the public. Aim: To investigate trends in US PEHSU lead contacts Methods: A retrospective study analyzed 7,512 total PEHSU contacts between 1/1/2007-12/31/2012. Seasonal and regional trends in lead contacts were analyzed along with patterns in location of lead exposure, route of exposure, patient geographic location, referral source, patient age and gender. Results: During the study period, lead was overwhelmingly the primary topic of concern for which the US PEHSU's were contacted (between 27-35% of the yearly contacts). It is of particular policy interest that the Region 1-New England PEHSU continually saw the greatest number of lead contacts, as much as 53% of their caseload. Conclusion: Despite the significant strides in lead policy and toxicity prevention, it remains a serious threat to children's health. This study demonstrated that a significant portion of the PEHSU lead contacts were coming from within the medical and public health community indicating many lingering lead care questions which need to be addressed. Moreover, this study showed that the PEHSU network is a valuable resource for evaluating patterns in children's environmental health and should be expanded to include further international members.

Abstract Number	**P-2-18-09**
Presenter	Eun-Hee Ha*, Min-ha Han, HyeSook Park, Yun Chul Hong, Yangho Kim, Boong-Nyun Kim, Mina Ha
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Is there an influence of maternal lead exposure on infantile development?

BACKGROUND : Infantile development could be affected by lead exposure during gestational period. We analyzed the influence of lead on twelve-month-old and twenty-four-month-old infants using Bayley Test. METHODS : This study is a part of MOCEH study which is an on-going, prospective birth cohort study in South Korea. Bayley test (K-BSID-Ⅱ) was conducted to measure infantile neurodevelopment when the children became 6, 12, and 24 months of age and mental developmental index(MDI) and psychomotor developmental index(PDI) from the test were used for outcome variables. We used the t-test in order to find differences and used multivariate analysis so as to control the variables. We used 'Time-varying effect model' and 'Linear mixed model' to find best fitted regression model. In addition, we used generalized additional model to see relationship between maternal Pb levels and infantile Bayley score. RESULTS : When we fitted the regression model to concentrations of lead on the Bayley score, we could assure that the slope-retrogressive point exist at the very low spot of the concentration of lead (Specifically, slope-retrogressive point was 1.00 with total's, 0.97 with 6months', 1.02 with 12 months', 0.98 with 24 months'PDI). Over the slope-retrogressive point, we found that Bayley score decreases with increase of lead levels significantly (beta = -0.23, p-value <0.001). Bayley score at 6 , 12, and 24 months, were significantly reduced by -0.28, -0.23, and -0.15 in PDI. CONCLUSION : As a result, we found that the concentration of lead is inversely proportional to the Bayley score of the infants. In comparison with Bayley score of the 12 months' infants, the 24 months' score was less influenced by the concentration of lead. Keywords : Retrogressive, Lead(Pb), Bayley,

Abstract Number	**P-2-18-10**
Presenter	Eric Rasmuson, Andrey Korchevskiy*, Jim Rasmuson
Exposure	metals
Health domains	neurobehavioral effects
Type of research	health impact assessment

Lead-in-Blood Safety Criteria for Young Children: International Applications and Ramifications

Background. In 2012, the U.S. CDC lowered the BLL of concern for young children from 10 to 5 µg/dL. This change was a result of continuing toxicological and epidemiological studies, which indicated the potential of comparatively low levels of lead in blood to cause significant neurological damage. It also reflects the absence of international procedures that would establish environmental and biological standards for various chemicals and agents. Aims.To summarize the toxicological and epidemiological evidence that resulted in the U.S. CDC lowering the Blood-Lead Level (BLL) of concern for young children from 10 to 5 µg/dL. To determine the implications of this change for risk assessment and management control in developed and developing countries. To discuss case studies on the public health impact of environmental lead contamination in different regions and the necessity of unified international policy and standards on lead. Methods. The average levels of BLL for young children in different world countries were evaluated and compared. The potential implication of the change in safety criteria was assessed from international standpoint. Results. In many developing countries, the public health impact of environmental lead contamination remains at serious levels. For example, in Shymkent, Kazakhstan, more than 40,000 of children suffer from the consequences of the continuing emissions from a lead smelter, and the international community has failed to collaborate with the local government to protect children. If the international BLL consensus standard is lowered, even larger population of children in developing countries could be considered as lead poisoned, but lowering the standard will not necessarily bring any relief to the affected regions. Conclusions. The science-based international policy on lead is needed to assist countries in determination of priorities in monitoring, education, remediation, emission control, and other public health protection measures.

Abstract Number	**P-2-18-12**
Presenter	Felicia Rabito*, Libby Horter, Elizabeth Langlois, Luann White
Exposure	metals
Health domains	respiratory disease
Type of research	cohort study

Pediatric Lead Exposure and Risk of Asthma

Background: Lead alters the immune system and is implicated in the development of atopic asthma. Studies looking at this association are limited primarily to cross-sectional designs. The objective of this study was to quantify the comorbidity of elevated blood lead and asthma and to determine whether elevated blood lead in early childhood is a risk factor for asthma in mid-childhood. Methods: A retrospective cohort study was conducted of 1,297 children having a venous blood lead test between ages 18–24 months with continuous Medicaid coverage through age 9. Multilevel analyses were performed to assess the contribution of individual and contextual effects to development of asthma. Results: 23% of children had a blood lead level ≥ 10 µg/dL and 20% developed asthma by their 9th birthday. Of diagnosed asthmatics, 59% had blood lead ≥ 5 µg/dL in early childhood. Blood lead ≥ 10 µg/dL was not a risk factor for asthma (aOR=0.92, 95% CI = 0.52-1.62). In multilevel analysis, black race (aOR=2.07, 95% CI = 1.38,3.10), male gender (aOR=1.59 95% CI = 1.19,2.13) and rhinitis (aOR=5.75 95% CI = 3.77,8.75) were significant predictors of asthma. Conclusion: In this high-risk cohort of children, the majority of asthmatics had elevated blood lead, however, elevated blood lead level was not a risk factor for asthma. After controlling for individual-level variables, neighborhood level variables did not contribute to asthma risk. Additional research is needed to describe the role that race and place plays in the development of asthma.

Abstract Number	**P-2-18-13**
Presenter	Mario Murcia*, Ferran Ballester, Sabrina Llop, Maribel Casas, Jesús Ibarlucea, Carmen Iñiguez, Mikel Basterrechea, Jordi Julvez, Isolina Riaño, Adonina Tardon, Marisa Rebagliato
Exposure	metals
Health domains	reproductive outcomes
Type of research	cohort study

Placental growth and duration of pregnancy in relation to prenatal mercury exposure

Background: Previous results of prenatal mercury exposure have shown moderate levels in Spanish newborns -mainly due to elevated fish consumption-, and have also shown a possible association with neonatal anthropometry. Moreover, there are scarce studies relating moderate chronic mercury exposure with other reproductive outcomes, such as gestational length and placental weight, which could play a critical role in the understanding of biological mechanisms involved in fetal growth. Aim: To assess the association between prenatal mercury exposure and placental weight and the length of gestation in a multicenter population based birth cohort. Methods: A total of 2506 children born between 2004 and 2008 in four cohorts (Valencia, Sabadell, Asturias, and Gipuzkoa) within the Spanish INMA project (Childhood and the Environment: www.proyectoinma.org). Cord blood total mercury was determined in 1886 samples. Cohort specific linear, logistic, and Cox models were adjusted to evaluate the association between mercury exposure and placental weight, placental to fetal weights ratio, preterm, and gestational length, respectively. Non-spontaneous labour was taken to be censoring in the survival analysis. Final estimates were obtained using meta-analysis, correcting for heterogeneity when appropriate. All models were adjusted for fish intake species and other potential confounders obtained through questionnaires. Results: A doubling in total mercury levels was associated with 7.6 grams decrease in placental weight (95% CI: -13.6, -1.7). This result was homogeneous among cohorts and showed a linear pattern. Placental to fetal weights ratio showed also an inverse nearly significant relation to mercury (% change: -0.7; 95% CI: -1.5, 0.1). Duration of pregnancy was not related to mercury concentration, although a heterogeneous pattern was observed among cohorts (I2=58%). Conclusions: These results suggest that prenatal exposure to mercury may affect placental growth, a marker of placental functional efficiency.

Abstract Number	**P-2-18-14**
Presenter	Byung-Mi Kim*, HyeSook Park, Yun Chul Hong, Yangho Kim, Mina Ha, Boong-Nyun Kim, Eunjeong Kim, Eun-Kyo Park, Eun-Hee Ha
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Prenatal mercury adversely affect neurodevelopment in infants with accelerated growth : MOthers and Childrens' Environmental Health (MOCEH) study

Background and aims: Previous studies suggested that mercury exposure and accelerated growth during infancy may influence on the early-childhood neurodevelopment, but the results remain unclear. Therefore, we aimed to investigate the relationship between prenatal exposure to mercury and neurodevelopment on accelerated growth during infancy. Methods: The prospective cohort study of Mothers and Children's Environmental Health (MOCEH) have been built up in 2006 and we enrolled 1,751 women before second trimester of their pregnancy and their partners in 2006-2010. Participants visited research center at 6, 12, and 24 months. We used the atomic absorption spectrophotometer to measure mercury level in blood. Questionnaires about infantile environment and health conditions were answered and anthropometric factors including body weight and height were measured, and neurobehavioral test(Bayley) were conducted by certificated investigators. Accelerated growth during infancy defined as upward growth curve percentile crossing between birth and age 2 year. We performed multiple linear regression model for statistical analyses (SAS 9.3). Results:The mercury concentration was 3.7μg/L in maternal blood during early pregnancy, 3.5μg/L in maternal blood during late pregnancy and 5.8μg/L in cord blood. The infants who experienced accelerated growth during the first 2 years were 11.11 %. The mercury level in cord blood on infants who experienced accelerated growth during the first 2 years was higher compared to the normal group. Mercury level of cord blood in the infants who experienced accelerated growth during the first 2 years was significantly decreased the bailey test cognitive scoresat 24 months adjusted for potential confounders (β=-24.43, se=12.22, p=0.05). Conclusion:Mercury level in cord blood was at increased risk for adverse neurodevelopment on infants who experienced accelerated growth during the first 2 years.

Abstract Number	**P-2-18-15**
Presenter	Yu-Cheng Chen*, Gurumurthy Ramachandran
Exposure	metals
Health domains	cardiovascular disease
Type of research	exposure measurement

Retrospective exposure assessment for the nickel production industry using a Bayesian framework

This study aims to reconstruct historical exposures to nickel-containing aerosols for workers in a nickel primary production industry using a Bayesian framework for future use in an epidemiological study of cardiovascular outcomes. This study also characterized variance components of exposure and examined the factors affecting nickel exposures. The Bayesian framework was used to synthesize expert inputs (based on historical information about workplace conditions) to an exposure model and incomplete historical aerosol measurements from 1950 to 2000 for 20 job titles within milling and smelting operations to estimate the posterior probability distributions of aerosol concentrations. These concentrations were further converted to inhalation nickel exposures. The distributions of the inhalable, thoracic and respirable particles size fractions and soluble, sulfidic, metallic and oxidic nickel species at the selected workplaces were also estimated to provide exposure “fingerprints” for the nickel primary production industry. The factors associated with nickel concentrations of exposure were examined in a mixed-effects model. The updated posterior probability distributions of inhalation nickel concentrations over time for 20 job titles were obtained. Exposure uncertainties for the posterior were somewhat narrowed due to lower within-job and higher between-job exposure variability as compared with the likelihood. The percentage of four nickel species was uniform across three aerosol size fractions. Sulfidic nickel was the predominant species in most workplaces. The significant factors (year and plant) affecting nickel exposure were identified. We have developed a job-exposure matrix that can enable estimation of cumulative exposures to nickel and its species for use in a future epidemiological study. Assessment of exposure variability allows us to minimize the misclassification of exposures.

Abstract Number	**P-2-18-16**
Presenter	Yaw-Huei Hwang*, Yi-Shuan Lin, Chia-Yu Lin, I-Jen Wang
Exposure	metals
Health domains	mental health
Type of research	cross-sectional study

Survey of multi-metal levels in blood samples of the preschoolers in Taiwan

Background—Advanced techniques for multiple trace metal analysis in the past decades substantially improved the measurement of trace metals in biological sample, which was widely used as biomarkers for environmental metal exposure. Meanwhile, low level multi-metal exposure caught more attention in Taiwan in recent years. Aims— The present study was conducted to profile the multi-metal exposure levels in ambient environment with the blood sample of preschool children in Taiwan, and to tentatively explore the significant factors influencing the distributions of these metals. Methods—In total, based on a stratified random sampling strategy, 934 kindergarten students were recruited from all around this island country from April to October 2011 after their parents have signed a statement of consent. Venous blood sample was drawn from each participant and analyzed for metal levels with inductively coupled plasma mass spectrometry. Results—The geometric means (geometric standard deviation) for blood metal levels were 18.6 ug/L (1.56) for lead, 0.183 ug/L (1.96) for cadmium, 13.7 ug/L (1.42) for manganese, 928 ug/L (1.25) for copper, 4329 ug/L (1.25) for zinc, 3.03 ug/L (1.94) for arsenic, 4.32 ug/L (2.01) for mercury. Lead exposure were associated household income and parental educational levels ($p < 0.0001$) as well as paternal occupation ($p<0.0003$) and incense-burning at home ($p=0.0012$). Blood copper, zinc, arsenic and mercury levels were associated with geographic location and township level ($p<0.001$). No dominant factor was identified for cadmium and manganese levels in blood samples. Conclusions—Significant factors affecting multi-metal levels in blood samples still could be identified in Taiwan, especially for lead, copper, zinc, arsenic and mercury. This inference should be considered and incorporated into the future prevention program in order to further reduce the environmental metal exposure.

Abstract Number	**P-2-18-17**
Presenter	Ling-Chu Chien*, Chuen-Bin Jiang, Tzu-Hsuan Yang
Exposure	neurotoxin
Health domains	neurodevelopment
Type of research	health impact assessment

The relationship between prenatal lead, cadmium, and arsenic exposure and their neurological effects at three years old in Taiwan

Lead, cadmium, and arsenic are well-known neurotoxins in children, with particular impact on neuro-development and intellectual performance. Fetus exposure to neurontoxins may have adverse developmental outcome. The aim of this study was to investigate the relationships between neurological effects and lead, cadmium, and arsenic concentration in meconium. In this study, we recruited mother-infant pairs between August 2008 and December 2009, and a second follow-up study of these children was completed after 3 years. We collected meconium after delivery as biomarkers for examine lead, cadmium, and arsenic exposure. The Bayley Scales of Infant and Toddler Development (Bayley-III) for evaluating the cognitive, language, and motor development of 3 years old children are calculated and validated. There were total 53 mother-child pairs in this study. The mean of lead, cadmium, and arsenic concentration in meconium was 253±180 ng/g, 60.7±14.8, and 52.0±13.6 ng/g, respectively. There were no significant negative correlation between lead, cadmium, or arsenic levels and the cognitive, language or motor development of Bayley-III scores. The score of expressive of language were higher in father s of higher levels of education and in mothers who consumed traditional Chinese herbs before pregnancy. The score of motor development were higher in fathers and mothers of higher levels of education, and girls. In conclusion, the results of the present study suggest that prenatal exposure lead, cadmium, and arsenic were not associated with early neurological development. Keywords: lead, cadmium, arsenic, neurological effects

Abstract Number	**P-2-18-18**
Presenter	Cian O' Mahony*, E.J. Daly
Exposure	others
Health domains	other
Type of research	exposure modeling

The RIFM Software for Aggregate Exposure Assessment to Fragrance Materials

Background: Consumer exposure assessment is essential to the risk assessment process for fragrance materials used in cosmetics and personal care products. Several hundreds of fragrance materials exist on the market, and currently no tool is available that can routinely assess consumer exposure to a given material, providing quantitative information on the drivers and sources of exposure in the marketplace. Furthermore, accurate exposure assessment requires large data inputs and can involve probabilistic modelling, which is computationally intensive. Aims: To develop a high-performance software system to estimate consumer exposure to fragrance materials, and which is also capable of implementing probabilistic exposure models exploiting all available data. Methods: A cloud-based server was used to host all the data and computational requirements for the developed databases and models, with a separate desktop application for viewing and performing the exposure assessments. Data on consumer habits and practices and fragrance use levels was obtained from the international cosmetic industry and fragrance industry respectively. Results: Outputs of the model include full statistical descriptions of total exposure per unit body weight and dermal exposure per unit of skin surface area, broken down by either body part or product with a variety of graphical output. The interface allows the user to select the products, fragrances, body parts, subject demographics, and calculation types to be considered in the assessment, which is run on the cloud and allows the results to be viewed on the user’s desktop computer. Conclusions: By harnessing the power of cloud computing, a software tool has been developed that can be used for routinely estimating consumer exposure to fragrance materials in consumer products.

Abstract Number	**P-2-18-19**
Presenter	Ching-Huang Lai*, Nain-Feng Chu, Shu-Li Wang, Jaakkola Jouni, Saou-Hsing Liou
Exposure	metals
Health domains	cardiovascular disease
Type of research	cross-sectional study

The risk of metabolic syndrome in relation to exposure to nickel; a cross-sectional study in Taiwan

Background: Metabolic syndrome is a strong predictor for the risk of diabetes and therefore determinants of metabolic syndrome are also determinants of diabetes. Aims: The objective of the present study was to assess the relation between exposure to nickel and the risk of metabolic syndrome. Methods: We conducted a cross-sectional study of 801 residents recruited from two different residential areas in central Taiwan during 2008-2009. A total of 623 individuals were selected from two townships, Lonjing and Dadu, located in within the 15 Kilometers radius of a power plant. A total of 174 individuals with similar age and gender distribution, were selected from a reference residential area, township of Shihgang, located 32 kilometers away from the power plant and without any industrial pollution. Eligible subjects were locally registered residents who had lived in the selected areas for more than five consecutive years and were between 35 and 64 years old. The study population underwent an interview and a health examination, where blood and urine samples were collected. Plasma nickel concentrations were measured by inductively coupled plasma-mass spectrometry. Metabolic syndrome was defined as the presence of three or more of the following criteria: elevated systolic (≧130 mmHg) or diastolic blood pressure (≧85 mmHg), fasting plasma glucose (≧ 110 mg/dl) , and triglyceride concentration (≧150 mg/dl), the body mass index (BMI≧27 kg/m2 for men and 25 for women), and high-density lipoprotein below 40 mg/dl. Results: In logistic regression adjusting for age, gender, occupation and behavioral factors including cigarette smoking, the risk of metabolic syndrome was significantly related to plasma Ni with an odds ratio of 1.05 (95% CI: 1.01-1.09, p=0.02) per 1 µg/l in plasma Ni. Conclusions: Metabolic complications appear to be associated with exposure to nickel.

Abstract Number	**P-2-18-20**
Presenter	Peter Rudnai*, Miklos Naray, Tamas Rudnai, Eszter Toth, Judit Kanizsai
Exposure	metals
Health domains	other
Type of research	exposure measurement

Urinary levels of some metals among children in the red sludge area

Background: Hungary's largest ecological disaster took place on October 4, 2010 when the western dam of a red sludge reservoir had ruptured, and a mixture of 700 thousand m3 of red sludge and water inundated the lower sections of the nearby settlements, causing 9 deaths and 150 injuries. At the affected sites, measures were promptly taken to neutralize the corrosive mud and clean the area. As the sludge has receded and its pH decreased, an environmental health surveillance system was initiated to monitor possible health consequences and to prevent further potential health risks to the population. Objective: to assess the possible health risk of the local population due to the dust exposure originating from the dried red sludge, by measuring the urinary levels of the selected metals in the „Red sludge" and the Control area, comparing the measured values to „reference values" and assessing the tendencies of urinary levels of metals in the two areas. Methods: Monthly 10-10 randomly chosen children were examined from both the exposed (Kolontár and Devecser) and the control (Ajka) settlements. Cadmium, nickel, arsenic, cobalt, chromium, aluminium and vanadium concentrations of freshly collected urine samples of alto-gether 351 children (176 from the affected and 175 from the control area) were analysed by inductively coupled plasma mass spectroscopy (ICP-MS). Both absolute and creatinine adjusted concentrations were evaluated. Results: There were no significant differences in the concentrations of various metals between the children's urine samples from the exposed and the control areas. In the studied period of 18 months, there was no increasing time trend observed, either. The measured concentrations were similar to those published in the international litera-ture referring to non-exposed areas. Conclusion: No increase of health risk due to the dried red sludge was observed by measuring the urinary levels of 7 metals among children in the area affected by the red sludge

Abstract Number	**P-2-20-01**
Presenter	Anna Mölter*, Angela Simpson, Bert Brunekreef, Elaine Fuertes, Ulrike Gehring, Olena Gruzieva, Claudia Klümper, Göran Pershagen, Raymond Agius
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

A multi-centre study of air pollution and childhood asthma in Europe - findings from the ESCAPE project

Background: The ubiquitous nature of air pollution exposure has made it a major concern for public health and a priority target for policy makers. The European Study of Cohorts for Air Pollution Effects (ESCAPE) is the largest pan-European project to date to assess population health effects of long term exposure to air pollution. Aim: To determine the effect of six traffic-related air pollution metrics (NO2, NOx, PM10, PM2.5, coarse PM, PM2.5 absorbance) on childhood asthma and current wheeze prevalence in five European birth cohorts: MAAS (England), BAMSE (Sweden), PIAMA (Netherlands), GINI and LISA (both Germany-divided into North and South areas). Methods: Individual land use regression models were developed for each study area and used to estimate outdoor air pollution exposure at the birth, age 4 and age 8 or 10 address of each child. Information on asthma and current wheeze prevalence at age 4 or 6 years and age 8 or 10 years was collected using validated questionnaires. Multiple logistic regression was used to analyse the association between pollutant exposure and asthma or current wheeze prevalence within each cohort. A random effects meta-analysis was used to combine effect estimates from individual cohorts into an overall estimate. Results: The meta-analyses showed no significant association between asthma or current wheeze prevalence at age 4/6 or 8/10 years and air pollution exposure at birth, age 4 or 8 years (e.g. adjusted OR (95%CI) for asthma at age 8/10 years and exposure at birth: 1.12(0.82-1.51) per 10µg/m³ NO2; 1.08(0.87-1.34) per 20µg/m³ NOx;0.88(0.64-1.20) per 10µg/m³ PM10; 1.30(0.87-1.94) per unit PM2.5 absorbance). This result was consistently found in initial crude models (only adjusted for age and gender), adjusted models and further sensitivity analyses. Conclusion: This study found no significant association between traffic-related air pollution exposure and childhood asthma or current wheeze prevalence in five large European conurbations.

Abstract Number	**P-2-20-02**
Presenter	Catherine Karr*, Christine Loftus, Jenna Armstrong, Griselda Arias, Elizabeth Torres, Maria Tchong-French, Michael Yost
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Aggravating Factors of Asthma in a Rural Environment Study (AFARE)

Background: In the U.S, asthma prevalence and morbidity are as high or higher for minority and low income rural children compared to urban children. Environmental factors associated with agriculture may be important but data are few. Objectives: To establish a longitudinal asthma cohort and residential ambient air monitoring network in a low income population that resides in an area of dense crop and dairy production. Methods: Within a community based participatory research partnership (El Proyecto Bienestar), fifty nine school age children with asthma were enrolled for 24 month assessment of asthma status including daily peak flow monitoring and biweekly composite scores of asthma (ACQ - Asthma Control Questionnaire). A novel active air sampler was constructed of multiple sampling media connected to individual critical orifices and a rotary vane vacuum pump. Fourteen were deployed at participant households in the last 18 months of the study. Collection of 24 hour samples every six days was done for determination of NH3, PM 2.5, total dust, endotoxin, and pesticides. Results: Fifty children provided data over more than 12 months. Peak flow measures were reduced for 18% of measures. Average ACQ scores for 13 subjects (26%) indicated poor asthma control (> 0.75). Scores showed spatial and temporal trends. Samplers performed well with accepted flow rates and were rated as not bothersome by households. Preliminary measures of mean and standard deviation of PM 2.5 and NH3 concentrations were 15.5 ± 13.2 µg/m3 and 30.1± 38.5 ppb, respectively. Conclusions: Longitudinal assessment of asthma in a hard to reach population can be successful in a community based framework. Observed ambient PM 2.5 concentrations exceed US EPA regulatory standards. Ambient ammonia concentrations exceed levels observed in a previous study in this region. The data bank of air samples and health outcomes provides a unique opportunity to evaluate the role of community air quality on asthma health in a rural context.

Abstract Number	**P-2-20-03**
Presenter	Gwi Heum Eom*, Su Ryeon Noh, Yong Jin Jeon, Jung Ah Kim, Hyun Sook Bae, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	persistent organic pollutants
Health domains	allergies
Type of research	cohort study

Allergic Sensitization in Inhabitants 4 years After the Hebei Spirit Oil Spill

Background: We found a significant dose-response relationship between the prevalence of allergic diseases assessed by questionnaire-based surveys and the Hebei Spirit oil spill exposure 1-2 years later. Aims: This study was to evaluate the relationship between the allergic sensitization assessed by skin prick tests and the Hebei Spirit oil spill exposure 4 years after the accident. Methods: Allergic sensitivity was concluded from a positive skin prick test among 12 species in 1147 residents in heavily affected area from the Hebei Spirit oil spill. Results: A positive response to at least one allergen was 13.7% of participants. The positive rate of allergic reaction was significantly elevated with increasing the distance from the oil spill point to the residence after controling the confounders in the model. The prevalenc of atopic sensitization to common aeroallergens was two times significantly higher in within 0.5 km from the early contaminated coastline to the residence as compared with over 1.0 km. Allergic sensitization showed a linear increase according to the total number of days of clean-up work, although the differnce was not statistically significant. Conclusions: Allergic sensitization was associated with the oil spill exposure indictors even 4 years after the accident. The crude oil constituents may increase susceptibility to common aeroallergens by enhancing the response to inflammatory stimuli.

Abstract Number	**P-2-20-04**
Presenter	Honghyok Kim*, Shinwoo Kim, Seulkee Heo, Jina Heo, Hyo-Mi Kim, Jong-Tae Lee
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Association between annually locality-level exposure to PM10 and adult-onset asthma with factors related to lifestyle; extended Cox proportional hazard model

Background:A number of studies have shown PM10 is associated with asthma in adults. However, most of those conducted either without or with few factors related to lifestyle. Aims:We estimated associations between annually locality-level PM10 and adult-onset asthma with factors indicating individual lifestyles including smoking, body mass index, basic livelihood security recipient, yearly income level, moderate physical activity and educational level. Methods:We employed 2008 Korean Community Health Survey providing individual information including physician diagnosed asthma. To determine subjects' individual exposure, annual PM10 values as community level were extracted from Annual Report of Ambient Air Quality in Korea. Applied to risk of asthma, extended Cox proportional hazards model were used in retrospective way. All subjects were thought as if they began being in follow-up simultaneously. PM exposure, age and smoking were treated as time-dependent variable. Sex and the lifestyle factors were also considered in the model. Results:The risk of PM10 was 0.992 (95% CI: 0.981-1.003) in men and 1.001 (0.992-1.011) in women while both that of age and smoking (daily average cigarettes per year) showed a statistically significant association with greater asthma onsets. BMI was positively associated in women (1.105, 1.084-1.125); however, it was negatively associated in men (0.965, 0.940-0.992). Those who received basic livelihood security service were found being in significantly higher risk of being the asthmatics. Higher yearly income level was significantly associated to lower asthma incidence. Moderate physical activity didn't have effect on the incidence. Educational level decreased the risk of adults onset asthma among men (P for trend=0.0184). Conclusions:Although our results are not statistically significant in association of PM10 with asthma-onset in adult, we suggest a couple of lifestyle factors can affect in this association. Our study results may not avoid a bias from measurement error on the estimation of the PM10 exposure level.

Abstract Number	**P-2-20-05**
Presenter	Olf Herbarth*, Matthias Richter, Thomas Richter
Exposure	no exposure
Health domains	allergies
Type of research	cross-sectional study

Association between Asthma Prevalence and Body Mass Index in Children

Background. Overweight is a growing problem. It is associated with diseases which are increase during the last decades. As an example both the BMI (Body Mass Index) and the asthma prevalence are increasing. The question is whether a link exists between these changes. Methods. In the frame of a longitudinal repeated cross-sectional epidemiological study 4925 children in total have been medical checked up. A questionnaire was filled out by the parents. Among other things data were gathered concerning anamnesis, physical measurements, and physician diagnosed diseases, like asthma. Describing the overweight in children's age between 6 and 15 years the BMI was divided in percentiles <10%, 10 to 25%, 25 to 75%, 75 to 90%, >90% respectively >97%. The full data set was available for 3946 children (80.1% of all participants). Results. The lifetime prevalence of asthma was 7.1% (age group until 15 years). The BMI was for the overweight group of 6/8/15 years old kids 18.1/20.1/24.5 kg/m² and in the adiposity group 20.2/22.4/27.7 kg/m² respectively. Frequent air way infections and parental predisposition enhance the risk for asthma (4.1 vs. 10.9%); boys are more affected than girls (8.1 vs. 6.1%). Starting with the 10%-BMI-percentile the asthma prevalence increases using the above mentioned intervals from 3.6% up to 8.3% for children with overweight (>90%-BMI-percentile). The logistic regression adjusted for relevant confounders (gender, smoking and passive smoking, parental predisposition, cats, duration of breastfeeding, socioeconomic status) confirms the descriptive results. The BMI dependent adjusted Odds Ratio (range) for asthma was 1.6 (95%CI: 1.0-2.7; p=0.048). Conclusions. The results clearly show that within the group of higher BMI more asthma will detected. Contrary to other studies this study may not confirm that the dependence on asthma from the BMI is bimodal since no higher asthma prevalence was observed in the lower BMI classes. Up to now this pilot study does not answer the question about the underlying processes.

Abstract Number	**P-2-20-06**
Presenter	Jina Heo*, Seulkee Heo, Jong-Tae Lee
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Association between exposure to particulate matter and doctor-diagnosed asthma in adults and obesity as an effect modifier

Background: A large number of studies about the effect modification of overweight/obesity on association between asthma and PM10 have conducted, but the results in adults remain inconclusive. Aims: The goal of this study was to evaluate relationship between ambient particulate matter and doctor-diagnosed asthma in adults and whether obesity modifies the association. Methods: A total of 5,242 adults living in Seoul aged 19 years and older from the Community Health Survey (2008) was analyzed after excluding those who reported that the length of their residence is less than 10 years and who diagnosed as asthma more than 10 years ago. BMI was classified into 3 groups including underweight (BMI < 18.5), normal (BMI 18.5-22.9), overweight (BMI ≥ 23.0). Measurements of PM10 concentration from 1999 to 2008 were obtained at annual report of air quality in Korea. We fitted logistic regression models stratified by BMI groups. Results: In total, 81 of 5,242 participants (1.6%) reported doctor-diagnosed asthma. Among study subjects, 5.7% (N=298) were underweight, 46.8% (N=2,455) were normal-weight, and 47.5% (N=2,489) were overweight. In both groups of underweight and overweight, we observed positive associations between PM10 concentration and doctor-diagnosed asthma after adjusting for sex, age, proportion of recipient of basic living, smoking and drinking habit. The effects on asthma were strongest in underweight (OR=1.07[0.88-1.29]), less strong in overweight (OR=1.04[0.96-1.12]), and weakest in normal-weight (OR=1.00[0.92-1.09]). Conclusions: Our results provide suggestive evidence supporting the hypothesis that BMI modifies relation between asthma and PM10 concentrationsin Korean adults.Further research is required

Abstract Number	**P-2-20-07**
Presenter	Won-Jun Choi*, Soyoung Hong, Wan Ryung Lim, Hojang Kwon, Hyung Jung Kim, Chaebong Kim, Jung Hoon Kim, Hae Suk Yang
Exposure	others
Health domains	allergies
Type of research	cross-sectional study

Association between Household Income and Asthma Symptoms among Elementary School Children in Seoul

Background: Along with the biological risk factors, social environment plays an important factor for childhood asthma. Aims: This study aimed to evaluate whether household income is associated with asthma symptoms in children, and whether this association varies by the number of siblings. Methods: A total of 6,919 elementary school children in Seoul were enrolled in the study. Data were obtained from a web-based questionnaire survey. The questionnaire was based on the International Study of Asthma and Allergies in Childhood core module. The preva-lence of wheeze in the past 12 months and severe asthma symptoms were obtained. The potential risk factors for asthma symptoms included household income and the number of siblings. A multiple logistic regression analysis was used to calculate the odds ratios (OR) and 95% confidence interval (CI) for the risk factors of asthma symptoms. Results: The prevalence of current wheeze (wheeze in the past 12 months) was 5.2%. Household income and asthma symptoms were inversely associated after adjusting for other potential risk factors (p for trend=0.03). This association was modified by the num-ber of siblings. With two or more siblings, the effect of household income on asthma symptoms was not significant. However, low household income was still a significant vari-able for patients with fewer than two siblings (OR 1.41; 95% CI, 1.09-1.81). Conclusions: It appears that childhood asthma disparity is dependent on household in-come. Policies to improve childhood health inequities should be emphasized.

Abstract Number	**P-2-20-08**
Presenter	Poonam Tyagi*
Exposure	ambient air pollution
Health domains	allergies
Type of research	others

Bioaerosols concentrations and antibiotics susceptibility patterns of Staphylococcus aureus (common human pathogen) isolates in air of tertiary care hospital of

Bioaerosols concentrations and antibiotics susceptibility patterns of Staphylococcus aureus (common human pathogen) isolates in air of tertiary care hospital of New Delhi, India Poonam Tyagi and Kasturi Mukhopadhyay School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India. Abstract Background: Airborne transmission is an important route for many microbial pathogens in outdoor and indoor environments, including hospitals. Staphylococcus aureus (S. aureus) is major human pathogen and common cause of hospital associated infections (HAIs). Aims: The objective of this study to determine the concentration and size distribution of bioaerosols and antibiotic susceptibility pattern of S. aureus isolates in different hospital areas. Methods: We collected air samples from different areas of tertiary care hospital situated in Delhi, India. Air samples were taken by the six stage Anderson impactor on nutrient agar plates. Results: The maximum number of bacterial aerosols concentration was observed from accident and emergency ward (2416.9 CFU/m3) followed by medicine OPD (1243.8 CFU/m3) and children ward (965.8 CFU/m3). The maximum number of fungal aerosols concentrations was obtained from accident and emergency ward (2134.2 CFU/m3) followed by medicine OPD (1491 CFU/m3) and orthopedics OPD (268.6 CFU/m3). We found that all the 18 MRSA isolates were resistant to more than two antibiotics and all (100%) of MRSA isolates were sensitive to vancomycin, rifampicin, linezolid and teicoplanin. Conclusions: The results of our study, in combination with recent trends observed in airborne transmission of S. aureus and their MDR pattern provide justification to further assess the health effects associated with, and hospital sources of, airborne S. aureus. The attention is particularly needed for the MRSA as it is a significant human pathogen and considerable burden on heath care system.

Abstract Number	**P-2-20-09**
Presenter	Anne-Sophie Merritt*, Niklas Andersson, Catarina Almqvist
Exposure	others
Health domains	allergies
Type of research	exposure measurement

Cat and house dust mite allergen content is stable in frozen mattress dust over time

Background: Dust from indoor environments consists of animal allergens, pollens, endotoxins and other substances which may exacerbate symptoms in sensitive individuals. In prospective cohort studies, dust is often collected from these environments in order to assess allergen exposure and possible relationships to health outcomes. Typically, large numbers of samples are collected and kept frozen until further analysis, which sometimes occurs several years later. To date, there is insufficient knowledge about what happens to the dust and its contents during storage. Aim: In the present study, our aim was to analyse allergen content over a 30 month period in frozen dust collected from beds in homes in order to simulate a study design of exposure assessment commonly used in epidemiological studies. Methods: Thirty-seven dust samples from mattresses in homes were collected using a Duststream dust collector. Each dust sample was distributed into six tubes. Dust from one tube (baseline) was extracted and analysed for cat and HDM allergen content using ELISA, all other tubes were stored at -80°C until further handling. Approximately every six months (6, 12, 18 and 30 months), dust from one tube was thawed, extracted and analysed the same way. Data was log-transformed and analysed using linear regression. Results: No trend for decreasing or increasing cat ($p=0.606$) or house dust mite ($p=0.928$) allergen levels in frozen dust could be observed over time. Levels of cat allergen were considerably higher in mattresses from homes with cats compared to homes without cats ($p<0.001$). Conclusion: It is important to assess the allergen stability in dust before designing costly and labour-intensive studies of allergen exposure and health outcomes, commonly used in environmental epidemiology. Although the present study showed that cat and HDM allergens seem stable in dust stored at -80°C during a 2.5 year period, analyses of other allergens or substances in frozen dust is desirable as well as evaluating the effect of longer storage periods.

Abstract Number	**P-2-20-10**
Presenter	Wenjie Sun*, Erik Svendsen, Johannes Forster, Joachim Kuehr, Wilfried Karmaus
Exposure	others
Health domains	allergies
Type of research	cohort study

Early-life antibiotic use is associated with wheezing among children with high atopic risk: a prospective European study

Background: Deliberate antibiotic use (AU) in early life may contribute to asthma. Although a number of published studies have tested AU in conjuction with the hygiene hypothesis, the results have been conflicting and little is known about the relationship between AU and asthma in the children with high atopic risk. Aims: To examine the association between the use of specific therapeutic antibiotics in the first year of life and wheezing by 36 months among high atopic risk children. Methods: A multi-center prospective cohort study was conducted among children at high-risk for atopic sensitization. A validated questionnaire was used to prospectively collect information on antibiotic use and potential risk factors for wheezing from parents or guardians of 606 children from 3 European countries at 6, 12, 24, and 36 months of age. Linear logistic regression model was used to adjust for potential confounders and estimate odds ratios (OR) with 95% confidence interval (CL) associated with antibiotic use for development of wheezing Results: Only macrolides' use in the first year of life was associated with increasing risk for wheezing, after adjusting for gender, socioeconomic status, breast feeding, tobacco smoke exposure of the infants, family history of asthma, and respiratory infection (OR=3.24; 95%CI 1.47-7.30). Among the children with respiratory infection, similar associations were observed for macrolides use (OR=3.42; 95%CI 1.46-8.01) and lower respiratory tract infection (OR=4.60; 95%CI 2.19-9.66). Conclusions: In European children with a familial risk for allergic disease, we found a positive association between macrolides use in the first year of life and wheezing until 36 months. Key words: antibiotic use, wheezing, prospective cohort

Abstract Number	**P-2-20-11**
Presenter	Zaitseva Nina*, Marina Zemlyanova, Oleg Dolgikh
Exposure	ambient air pollution
Health domains	allergies
Type of research	cross-sectional study

Formaldehyde exposure and allergic sensitization in children

Background Among the hazardous substances in the air, formaldehyde deserves special attention. Children with chronic formaldehyde exposure of 0,0005-0,0007 mg/(kg·day) show signs of respiratory allergic reactions as confirmed by a survey. Goals Detect and evaluate an interrelation between the development of allergic sensitization in children and formaldehyde exposure in the inhalation Methods Assessed formaldehyde concentration in the blood and IgE specific to formaldehyde (sIgE) in blood serum of 1600 children (815 girls and 785 boys) from 5 regions of Russia (aged 4-7) in 2009-2011. Study participants were of the same racial and ethnic background, health group (no hereditary diseases), and level of financial security. Formaldehyde concentration in the blood of children above 0,005 mg/dm3 served as the indicator of exposure. Positive test reaction (sIgE > 2,11±0,31 ME/dm3) served as a criteria for sensitization to formaldehyde. All the study participants were divided into 4 groups in terms of formaldehyde concentration in blood. The odds ratio (OR) was used to determine the interrelation. With OR ≥ 1 (Fletcher, 1998), the interrelation was determined as present. Results A higher formaldehyde level of 0,0087 - 0,068 mg/dm3 was detected in 87% of blood samples in children, and 57% of them had positive test reaction to allergic sensitization to formaldehyde A firm interrelation has been established between the level of formaldehyde in the blood and development of sensitization to formaldehyde in children. The odd ratio of sensitization to formaldehyde in the test group of children as compared to the control group was: OR =1,47-2,46 (CI = 1,15 - 3,92, EF = 71,1%). Conclusion It has been determined that formaldehyde exposure results in higher formaldehyde level in blood and credible development of allergic sensitization to formaldehyde in a representative sample of children from different regions of Russia. The results are consistent with the results of other studies.

Abstract Number	**P-2-20-12**
Presenter	Delphine Meheust, Tiina Reponen*, Stephen Vesper, Jean-Pierre Gangneux
Exposure	microbial environment
Health domains	respiratory disease
Type of research	exposure measurement

Home exposure to molds: quantitative PCR using the Environmental Relative Moldiness Index (ERMI) compared to fungal cultures in French dwellings

Background. Asthma is associated with observed water-damage and fungal growth (WHO, 2009). The analysis of fungal populations in homes has commonly been based on the collection of short air samples followed by microscopic enumeration, either directly by observing the spores or by culturing the fungi on one or two media. Aims. Here, we aimed (i) to determine if the Environmental Relative Moldiness Index (ERMI) scale, a DNA-based metric developed to describe the fungal contamination in US dwellings, might have application in France with regards to the fungal biodiversity observed, and (ii) to determine if the ERMI values were correlated with other measures of fungal contamination. Methods. Dust and air samples (MiTest and Coriolis) were obtained from 40 dwellings in north western France and analyzed by quantitative PCR (QPCR) for the 36 fungi that make–up the ERMI and by culturing. These dwellings were also classified by inspection as “Moldy” or “Non-Moldy”, and the amount of visible fungal growth estimated in m2. Results.The ERMI values in these dwellings ranged from -2.7 to 28.8 and the fungal contamination estimates ranged from 0 to 20 m2. The 40 dwellings were divided into those with a low (<6) or high (>8) ERMI values (n=20 in each). The average ERMI value was 15.70 for the high ERMI compared to 2.68 for the low ERMI dwellings. ERMI values were correlated with concentrations of fungi in air samples analyzed by QPCR or culturing, and were also correlated with the visible estimates of fungal contamination. Conclusion. These same 36 fungi may be useful in creating an ERMI for France. A metric like the ERMI describes mold burdens in homes on a continuum, as opposed to the frequently used dichotomous approach (moldy vs non-moldy). Furthermore, our results suggest that the ERMI dust sample, which is quick and easy to obtain, can possibly substitute for other approaches to determining fungal contamination and be useful in making decisions about reducing exposures to fungal contamination in homes.

Abstract Number	**P-2-20-13**
Presenter	Reginald Quansah*, Maritta S. Jaakkola, Timo Hugg, Sirpa Heikkinen, Jouni Jaakkola
Exposure	others
Health domains	allergies
Type of research	meta-analysis

Indoor dampness and moulds and the risk of rhinoconjunctivitis: A systematic review and meta-analysis

Background A substantial proportion of the world's population is exposed to indoor dampness-related exposures. Since the 1990s studies have assessed the relation between indoor dampness and mould exposures and rhinitis, but the evidence has been inconclusive. No previous meta-analysis on this topic has been reported. Aims We conducted a systematic review and meta-analysis of studies on the relations between indoor dampness and mould and the risk of different types of rhinitis, and investigated whether these relations differ according to the type of exposure. Methods A systematic search of Ovid MEDLINE and EMBASE databases was conducted from 1950 through August 2012 and the reference lists of relevant articles were reviewed. Cross-sectional, case-control and cohort studies in children or adults were selected according to a priori criteria. Three authors independently evaluated articles using a structured form. Results Altogether 31 studies were included. The meta-analyses showed that the risk of rhinitis (Rh) was increased in relation to dampness (Effect estimate (EE) 1.82, 95% CI 1.34-2.46), visible mould (1.82, 1.56-2.12) and mould odour (2.18, 1.76-2.71) but not for water damage (1.71, 0.69-4.22). Any exposure to dampness or mould indicators was significantly related to rhinitis (2.08, 1.56-2.76). Conclusions This meta-analysis provides new evidence that dampness and moulds in the home are determinants of rhinitis. The associations were especially strong with mould odour suggesting importance of microbial causal agents. Our results provide evidence that justifies prevention and remediation of indoor dampness and mould problems and such actions are likely to reduce rhinitis.

Abstract Number	**P-2-20-14**
Presenter	Chi Hsien Chen*, Yue Leon Guo, H. Jasmine Chao
Exposure	microbial environment
Health domains	allergies
Type of research	cross-sectional study

Indoor fungal spores of school and current asthma in schoolchildren.

Background: Visible mold in children's classroom has been associated with current asthma symptoms in schoolchildren. However, studies on the roles of specific fungal spores on asthma symptoms were limited. Aims:This study aims to assess the relationship between asthmatic conditions and specific airborne fungus in classrooms.Methods: Between April to May 2011, we conducted a cross-sectional survey for allergic diseases in schoolchildren aged 6~15 years in 44 schools in Taiwan.History and current symptoms of allergic diseases were inquired by using questionnaire compatible with International Study of Asthma and Allergies in Childhood (ISAAC). Fungal spores were collected by Burkard Personal Air Sampler in 264 classrooms, and counted by light microscope. Three-level hierarchical non-linear modeling was applied to compare the individual asthmatic conditions to concentration of fungal spores in classrooms. Results: Totally, 6346 of 7154 (88.7%) children's parents completed the questionnaire. The prevalences of ever-having physician-diagnosed asthma, current asthma, and asthma with symptoms reduced on holidays (ASROH) were 11.7%, 7.5%, and 3.1%, respectively. After adjusting for personal factors, correlated fungal spores and schools, higher prevalence of current asthma and ASROH was found in classrooms with higher levels of aspergillus/penicillium and basidiospores. Conclusions: Indoor fungal spores in classrooms were highly associated with the prevalence of current asthma and ASROH in schoolchildren. Future investigation on potential sources for indoor aspergillus/penicillium and basidiospores may extend the knowledge on causes and environmental remediation of asthma in schools.

Abstract Number	**P-2-20-15**
Presenter	Daniel Aubin*, Doyun Won, Hans Schleibinger, Pierre Lajoie, Véronique Gingras, Denis Gauvin, Jean-Marc Leclerc, Marilène Courteau, Suzanne Gingras, Don Fugler
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cohort study

IVAIRE - A Randomized Controlled Study on the Impact of Ventilation on IAQ and the Symptoms of Asthmatic Children in Single Family Homes – Environmental Aspects

Background and Aims Our study evaluated the impact of improved ventilation on indoor air quality (IAQ) and the frequency of asthma symptoms in children in residential buildings. This paper discusses the impact of residential ventilation rates on IAQ. Methods A randomized controlled study was conducted with 83 asthmatic children (ages 3 to 12 years) living in homes with ventilation rates < 0.3 h-1. During year 1 (pre-intervention) and 2 (post-intervention), the ventilation rates and a number of IAQ relevant chemical, biological and physical parameters were measured during two home visits in the heating-season and one visit in the summer. Following year 1, participants were randomized (43 I; 40 C).The ventilation rates were increased in the homes of participants of the intervention group by optimizing the existing mechanical ventilation systems or by the addition of a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV). A generalized linear model was used to assess the difference in outcomes between intervention and control group. Results Following the intervention the mean air exchange rate (h-1) increased from 0.17 (1.06) to 0.34 (1.06) in the intervention group compared to 0.18 (1.06) and 0.21 (1.06) in the control group ($p<0.0001$). The mean heating-season concentration of formaldehyde (µg m-3) decreased from 37.2 (1.07) to 24.1 (1.07) in the intervention group compared from 36.5 (1.08) to 35.4 (1.08) in control group ($p<0.0001$). Following the intervention all homes in the intervention group were able to meet formaldehyde guideline of 50 µg m-3 for an 8-hour exposure compared with only two thirds prior to the intervention. Significant reductions in the concentrations of IAQ relevant parameters were also observed in the intervention group. Conclusions This study demonstrates that under-ventilated homes can be corrected through a careful retrofit with H(E)RV systems and that the concentration of potentially health relevant chemical and microbial IAQ parameters can be significantly reduced with increased ventilation.

Abstract Number	**P-2-20-16**
Presenter	E Jin Kim*, Ho Kim, Youn-Hee Lim
Exposure	others
Health domains	respiratory disease
Type of research	time series study

Model selection(absolute humidity and relative humidity) and Akaike's information criterion(AIC): Association between humidity and asthma admission

Background- There are published many studies of humidity effect on health condition. Humidity condition affects severity of asthma symptom. When studying association between humidity and health outcomes, we more use relative humidity than absolute humidity. We need to examine validity of humidity indicators. Aims-This study are to examine validity of using humidity indicator about association between humidity and health conditions Methods-We used the generalized additive model (GAM) to analyze data which is daily weather and asthma admission in Korea from 2003 to 2006 for humidity effect on asthma. Using asthma admission data of 6 cities, we analyzed to change humidity indicators absolute humidity and relative humidity respectively after controlling air pollution condition, temperature. Calculating moving average each of variables we controlled lag effect. Results-Among 6 cities, Seoul and Kwangju cities did not show significant results about humidity effect on asthma admission. In Busan and Incheon cities, AIC was calculated in the model with absolute humidity is lower 12176.87 (RR: 0.9398 95% CI : 0.9023-0.9788) , 9234.068 (RR :0.9064, 95% CI: 0.8468-0.9701) respectively than that of using relative humidity. On the other hand, Daegu and Daejeon is shown higher AIC in model with using absolute humidity that of relative humidity model. AIC of Daegu and Daejeon cities are 9064.49 (RR: 0.9577, 95% CI: 0.9381-0.9776), 7668.60 (RR: 0.9479, 95% CI: 0.9208-0.9759) in relative humidity model. Conclusions-This study did not show evidence to select which humidity indicator clearly. However Busan and Incheon Cities showed lower AIC in absolute humidity model whereas AIC of Daegu and Daejeon was lower in relative humidity model. Salient different of these cities is founded geographical position. Busan and Incheon city is closer coast. On the contrary, Daegu and Daejeon city is inland city.

Abstract Number	**P-2-20-17**
Presenter	Anuar Mohd Mokhtar*
Exposure	microbial environment
Health domains	respiratory disease
Type of research	health impact assessment

Mould Growth and Effects to Occupants in a Government Building

Background Due to a complaint lodged with the Department of Occupational Safety and Health in 2012, an investigation at a six storey building occupied by a government agency was carried out. Aims The investigation was to identify sources of mould growth, to identify occupants with signs and symptoms of sick building syndrome (SBS) and to propose measures to alleviate the situation. Methods A questionnaire interview was conducted on occupants; an inspection of the building and the mechanical ventilation and air-conditioning system (HVAC); and measurements of selected indoor air quality (IAQ) parameters were conducted. Results Results showed airborne mould and bacteria concentrations at all six floors of the buildings were below the standard values set by the Malaysian Industry Code of Practice on Indoor Air Quality 2010 of 1000 cfu/m3 and 500 cfu/m3 respectively. More than 50% of occupants reported symptoms of SBS. Conclusions Reducing RH, use of alternative partition boards and good maintenance of HVAC should prevent recurrence of this problem. Although airborne mould concentration was low and the relative humidity (RH) was below 70%, mould growth was visible on partition boards and other surfaces in nearly all offices in the building and the health and comfort of the occupants were affected. Existing Malaysian standard on airborne mould concentration is insufficient to provide protection and comfortable environment to occupants.

Abstract Number	**P-2-20-18**
Presenter	In-Bo Oh*, Yangho Kim, Kee-Ryong Choi, Ji Ho Lee, Jin-Hee Bang, Cheol-In Yoo
Exposure	others
Health domains	allergies
Type of research	exposure modeling

Numerical simulation of allergic pollen over a coastal city in Korea

Background: The recent increase in prevalence of allergic diseases and climate change stimulate the interest in allergic pollen. Numerical modeling techniques can enhance our understanding about spatiotemporal pollen patterns and help to achieve a better management of pollen-related allergic diseases. Aims: This study aims to simulate oak pollen distributions in multiscale domain using a new model system developed by modifying the existing pollen emission and air quality models and to evaluate modeled concentrations for urban scale prediction with observations in Ulsan city, Korea. Methods: Gridded inventories of oak pollen sources were calculated by a pollen-emission model using the Weather Research and Forecasting (WRF) model-based meteorology fields and detailed land cover information. The emission model was incorporated into the modified Community Multiscale Air Quality (CMAQ) model which can address pollen dispersion and deposition in urban and regional scales. A 10 day-run for oak pollen simulation was conducted using the developed model during an episode of the 2011 spring pollen season. Results: Modeled pollen concentrations were evaluated against data collected at the Ulsan Environmental Health Center sampling site within the model domain. Overall, the simulated temporal patterns reasonably followed the measured profiles of oak pollen, but there were large differences between modeled and measured concentrations at certain times due to the discrepancy in winds. Some simulations indicated nighttime peak of oak concentration was closely associated with regional transport under strong wind condition and change in boundary layer structure. In addition, the inflow of marine air masses mainly contributed to decrease in surface oak concentrations in the city atmosphere. Conclusions: The present study describes the successful application of air quality modeling system to simulate oak concentration in urban scale. However, a better understanding of the pollen release and deposition processes will be needed to improve pollen prediction by numerical models.

Abstract Number	**P-2-20-19**
Presenter	Christina Tischer*, Lidia Casas, Inge M Wouters, Raquel s, Anne Hyvärinen, Jordi Sunyer, Maties Torrent, Joachim Heinrich
Exposure	microbial environment
Health domains	allergies
Type of research	cohort study

Perinatal exposure to bio-contaminants in house dust in relation to respiratory and allergic health in children. Results from the HITEA project.

< Background:Exposure to endotoxin at home was reported to have protective effects on asthma and allergy symptoms, however, predominantly observed in cross-sectional studies among children from farming and rural surroundings. Aims:We aimed to assess prospectively whether exposure to elevated levels of endotoxin, ß(1-3)-glucans and Extracellular Polysaccharides (EPS) in house dust early in life is associated with lower risks for atopic diseases and respiratory symptoms in children from urban areas during the first years of life. Methods:In subsets of three prospective European birth cohorts from a predominantly urban environment (LISAplus, PIAMA and INMA), endotoxin, ß(1-3)-glucans, and EPS were measured in living room floor dust, collected at 2-3 months of age. Respiratory symptoms and a diagnosis of asthma, hay fever and eczema during childhood were periodically obtained by parental questionnaires up to 10 years of age. Adjusted cohort-specific logistic regression estimates were combined using random-effects meta-analyses. Results:The total study population comprised 1429 children from three European countries. There was significant heterogeneity between the birth cohorts regarding the distribution of the bio-contaminant concentrations. In preliminary analyses, early exposure to endotoxin was not statistically significant associated with asthma. Higher levels of exposure to ß(1-3)-glucans early in life were observed to decrease the risk for physician-diagnosed eczema at school-age: 2nd quartile vs. 1st aOR: 0.53 (0.35-0.82). No dose-related association was found. Exposure to EPS was not associated with any of the investigated health outcomes. Conclusion:Our results do not support the idea of a long-term priming of the immune system by early life exposure to bio-contaminants in children.

Abstract Number	**P-2-20-20**
Presenter	Hui-Ju Wen*, Tung-Liang Chiang, Shio-Jean Lin, Wen-Kuei Lin, Yue Leon Guo
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Predicting risk for childhood asthma by prenatal, perinatal, and postnatal factors

Background: Symptoms of asthma start early in human life, important life and environmental factors cannot be studied in detail if the participants are preschool children or older. Aims: To investigate the early risk factors for childhood asthma and to develop a predictive model for the development of asthma by birth cohort study. Methods: A representative sample of mother-newborn pairs was obtained by multistage, stratified systematic sampling from the Taiwan national birth register in 2005. Home interviews at 6 months and 5 years of age were conducted to inquire potential risk factors and children's health status, respectively. Multivariate regression analysis was used to determine the risk factors for children asthma in predictive models. Area-under-curve (AUC) statistic from receiver-operating characteristic curve analysis was used to compare the ability of models to discriminate between children with and without asthma. Results: A total of 19,192 mother-newborn pairs completed the study satisfactorily. The prevalence of physician-diagnose asthma was 7.6% in boys and 5.5% in girls, respectively. Prenatal (parental atopy and socioeconomic status), perinatal (resident area and painting wall during pregnancy), and postnatal factors (mother with postpartum stress and children with atopic dermatitis (AD) before 6 months old) were chosen in predictive models by backward stepwise analysis. The highest predicted probability of asthma was 68.1% in boys and 76.1% in girls with above factors. The lowest probability was 7.7%, among boys and girls with none of above factors, respectively. Compared with AUCs of prenatal factor model and the model adding perinatal factors, model more adding postnatal factors provided significantly higher ability to discriminate between children with and without asthma. Conclusions: This investigation provides technique for predicting risk of childhood asthma by prenatal, perinatal, and postnatal factors that can be used for developing preventive strategy against asthma, especially among those children with AD and family history of atopy.

Abstract Number	**P-2-20-21**
Presenter	Albino Barraza-Villarreal*, Maria Consuelo Escamilla-Nuñez, Leticia Hernandez-Cadena, Efrain Navarro-Olivos, Peter Sly, Isabelle Romieu
Exposure	gene-environment interactions
Health domains	allergies
Type of research	health impact assessment

Prenatal exposure to allergens in home and respiratory symptoms in Mexican infants

Objective:To determine the impactof prenatal exposure to allergens in home on increased respiratory symptoms in children until 18 months of age.Methods: We included 253 infants whose mothers participated in a randomized clinical trial of supplementation with omega-3 during pregnancy. Information on respiratory symptoms was obtained by questionnaire at 1,3, 6, 9, 12 and 18 months of age. During pregnancy we obtained information on sociodemographic characteristics, health and obstetric history, maternal stress and environmental exposure and the presence of allergens in dust samples collected in home during pregnancy(dust mite (Der p 1, Derf 1, Mitegroup2), cat(Fel d1), dog(Can f1), Rat(Rat n1), mouse (Mus m1) and cockroach (Bla g2)) using multiplex kit. We ran negative binomial regression models to assess the impact of prenatal exposure to allergens on the incidence of symptoms.Results: The incidence of respiratory symptoms was higher in children whose mothers received placebo (p =0.083). We observed a negative impactof exposure to allergens in home on the incidence of respiratory symptoms, mainly cough,wheezing, shortness of breath and phlegm in the presence of runny nose and nasal congestion (p <0.05). Supplementation with omega-3 fatty acids during pregnancy reduced the risk of respiratory symptoms.Conclusions: These results strengthen the evidence that prenatal exposure to allergens in the home increases the incidence of respiratory symptoms in childhood. Keyword: Omega 3, respiratory symptoms, dustallergens, prenatalexposure

Abstract Number	**P-2-20-22**
Presenter	Leticia Hernandez Cadena*, Albino Barraza-Villarreal, Maria Consuelo Escamilla-Nuñez, Efrain Navarro-Olivos, Blanca Estela Del río Navarro, Fernando Holguin, Romieu Isabelle
Exposure	no exposure
Health domains	obesity
Type of research	cohort study

Proinflammatory Cytokines in Plasma, local inflammation and symptoms of asthmatic and non asthmatic Prepubertal Obese Children.

Background. It has not clear in prepubertal children how cytokines, body mass, as well as asthma condition are interrelated. The aim of this study was to explore the relation between circulating levels of some cytokines with body mass index, local inflammation and symptoms manifestation in asthmatic and non asthmatic children in a longitudinal study. Material and methods. From a cohort of 50 obese adolescents (30 asthmatics (A) and 20 non-asthmatic (NA)) who was subjected to a program with nutritional counseling to reduce weight, we assessed the possible interaction between BMI and asthma in the systemic inflammatory response (cytokines proinflamatiorias), pulmonary function, nitric oxide in exhaled air and symptoms manifestation. The analysis was carried out using repeated measures mixed model. Results. The Th1 and Th2 responses were higher in asthmatic patients than in non-asthmatics (IL2: A = 1.35 vs NA = 0.77 ug / dl; IL6:. A = 0.49, 0.30). IL6 increased as BMI increased, showing a significant interaction between obesity and asthma. A relationship between blood concentrations of IL6 and lung function (FEV1) and FENOx (negative and positive respectively) was observed, being higher in asthmatic patients than no asthmatic, opposite relationship between blood IL2 concentrations and lung function (FEV1) and FENOx (positive and negative respectively) was observed being higher in asthmatics than non-asthmatics. Symptoms were major in obesity group with asthma. Conclusions. Obesity may be a low-grade systemic inflammatory disease It is probable that part of the systemic inflammatory response has a direct effect on the local inflammatory response from a chronic inflammatory state. The Th1 response may play an important role in this mechanism.

Abstract Number	**P-2-20-23**
Presenter	Irvan Luhung*
Exposure	microbial environment
Health domains	allergies
Type of research	health impact assessment

Protocol Optimization on Bioaerosol Analysis in Tropical Buildings

Protocol Optimization on Bioaerosols Analysis in Tropical Buildings Indoor bioaerosols had attracted increasing concerns because of the potential linkage with various health and work efficiency issues. Bioaerosols are of special interests in tropical urban environment which has higher temperature and relative humidity all year round. This study aims to understand the role of HVAC system in air conditioned office buildings in Singapore. We firstly explore various strategies to optimize the bioaerosol analysis protocol suitable for local context. The bioaerosol concentration levels and the correlation between building characteristics as well as the occupants' activities are also investigated. Protocol optimization includes the sample collection, extraction , and analysis steps. Samples are collected from various microenvironments in the HVAC system, such as air duct, filters, drip pan and heat exchanger pipes. Other potential indoor bio-reservoirs such as wall surface, carpets and ventilation outlets are also included for reference purpose. DNA based analysis including qPCR and Pyrosequencing are applied to gain an in-depth understanding of the role of HVAC system at different time and operation conditions. Primary results had indicated the importance of HVAC system. The maintenance plays a critical role on the indoor bioaerosol level. Current building maintenance guideline might not be sufficient to warren a good indoor environment without bioaerosol contamination. In addition, a high correlation between human activities and bioaerosols concentrations was confirmed. Similar to other studies, re-suspension of settled particulate matter as well as human sheddings are identified as important sources. However, the higher bioaerosol levels might imply the contribution from the warm and humid ambient environment in the urban tropics.

Abstract Number	**P-2-20-24**
Presenter	Jacob MENSAH-ATTIPOE*, Tiina Reponen, Anniina Hellsten, Anna-Maria Veijalainen, Pertti Pasanen
Exposure	microbial environment
Health domains	respiratory disease
Type of research	health impact assessment

Susceptibility of green and non-green building materials to microbial growth

Background: Biological growth on building materials is directly linked to exposure of these materials to moisture. Growth of microbes also depends on the chemical composition of the material. Therefore selection of materials that will prevent the onset of the microbial growth in the presence of moisture-damage is important. Methods: In the present study, we evaluated the growth of three different fungi – Aspergillus versicolor, Cladosporium cladosporioides and Penicillium brevicompactum – on five building materials: green (acoustic board 1 and haltex) and non-green (acoustic board 2 and gypsum board). Wood was included as a conventional material. Different surfaces of the materials were inoculated with fungi, in the absence and presence of house dust. The water holding capacity (WHC) of materials was determined by immersing building material samples in water until they were fully saturated. WHC was expressed as the mass ratio of water to dry materials. Microbial growth was assessed at four different time points (day 0 and weeks 1, 2 and 4) by cultivation and determining fungal biomass using the NAHA enzyme assay. Results: The results showed that NAHA activity and culturable count correlated well for A. versicolor, (R2=0.61) C. cladosporioides (R2=0.57), but not for P. brevicompactum (R2=0.18). The presence of dust serving as external source of nutrient promoted growth of all the fungal species on gypsum board and wood. Also, wood and gypsum board in the absence of dust supported significant growth. The top surfaces of the two acoustic boards had little or no activity while the sides of the same materials had significant activity. Even though haltex had the highest WHC, it did not support significant microbial growth compared to gypsum board and wood, which had lower WHCs. Conclusions: The results suggest that the growth of microbes on a material surface depends on the availability of organic matter on the material surface rather than the classification of the material as green or non green.

Abstract Number	**P-2-20-25**
Presenter	Chien-Cheng Jung*, Chih-Ching Chang, Yau-Sheng Tsai, Huey-Jen Su
Exposure	others
Health domains	respiratory disease
Type of research	exposure measurement

The Effect of Acute Allergen Exposure on Adiponectin Levels in Serum and Adipose Tissue

Background: Epidemiological studies indicated that allergen exposure can be linked to higher risk of cardiovascular diseases (CVD). Compared with health population, patients with CVD has lower serum adiponectin levels which play a protection role for CVD. However, remains less understood how the allergen exposure to impact on adipose tissue and later the adiponectin levels. Aims: The objective of this study is to investigate whether acute exposure to OVA (Ovalbumin) allergen can affect adiponectin levels of serum and adipose tissue which play a protective role in diabetes or cardiovascular diseases. Methods: An acute intranasal challenge model with OVA (Ovalbumin) using male C57BL/6 mice was performed at dose of 6.25, 12.5, 25, 50 and 100 µg, and control mice was challenged with PBS (Phosphate Buffered Saline). BALF (Bronchoalveolar lavage fluid), serum and adipose tissues were collected 24 hours after the last intranasal challenge. IL-5 of BALF, adiponectin, total IgE and OVA-specific IgE of serum were analyzed by ELISA (Enzyme-linked immunosorbent assay). Real-time PCR was used to analyze the expressions of IL-6 and TNF-α in gonadal and inguinal adipose tissues. Results: Results showed that acute OVA exposure did not only cause airway inflammation in study mice, but also decrease adiponectin levels in serum with a dose-response effect. When examining the gonadal adipose tissues, there was no significantly difference of adiponectin mRNA in OVA challenged mice compared to those PBS challenged, but lower inguinal adiponectin mRNA expression was found compared to those PBS-challenged. All adipose tissues of OVA challenged mice, including gonadal and inguinal, have higher IL-6 and TNF-α expression. Conclusions: Our data indicate that acute OVA exposures appear to cause inflammation in adipose tissues, and affect the adiponectin levels in serum and adipose tissues. Allergen exposure is therefore considered a potential risk factor for presenting diabetes or cardiovascular diseases.

Abstract Number	**P-2-20-26**
Presenter	I-Jen Wang*, Pau-Chung Chen
Exposure	organic compounds
Health domains	allergies
Type of research	cohort study

The effect of phthalate exposures and Glutathione S -transferase polymorphisms on atopic disorders

Background: Evidence has shown that phthalates may increase the risk of atopic diseases in children. However, little is known about how the genotype modulates the risk of phthalates exposure on atopic dermatitis (AD). Aims: To evaluate the effect of Glutathione S -transferase (GST; a major detoxification enzyme) genotypes polymorphisms and phthalates exposure on AD. Methods: We conducted a case-control study comprised of 44 AD children and 88 controls, all of whom were selected from Taiwan Birth Panel cohort study. Urine phthalate metabolites levels (MEP, MBP, MBzP, and MEHP)were measured by ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). At 2 years of age, information about development of AD and environmental exposures were collected. We compared AD with non-AD children for GST polymorphisms stratified by the urine phthalate metabolites levels. Multiple logistic regressions were performed to estimate the association of genotypes polymorphisms and phthalate levels with AD. Results: GSTM1 null genotypes showed a significant increase in the risk of AD with OR (95%CI) of 2.73(1.26-5.94). After stratifying by the median levels of phthalate metabolites, we found GSTM1 null genotype was significantly related to AD in children with MBzP level <4.53 ng/ml (OR= 5.37, 95%CI 1.57-18.34) and MEHP levels≧31.61 ng/ml (OR=5.12, 95%CI 1.58-16.59). There is no significant effect of other GST genotypes. Conclusions: Genetic polymorphism in GSTM1 may modify the risk of phthalate exposures on AD.

Abstract Number	**P-2-20-27**
Presenter	Rima Habre*, Erin Moshier, William Castro, Amit Nath, Avi Grunin, Annette Rohr, James Godbold, Neil Schachter, Meyer Kattan, Brent A. Coull, Petros Koutrakis
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

The Effects of PM2.5 of Outdoor and Indoor Origin and Ozone on Cough and Wheeze Symptoms in Asthmatic Children

Background:Particulate matter with aerodynamic diameter less than 2.5 µm (PM2.5) is associated with exacerbation of pediatric asthma. Objective: To investigate the association of indoor PM2.5 of indoor and outdoor origin and its components with cough and wheeze symptoms. Methods: The Children's Air Pollution Asthma Study enrolled 36 asthmatic children living in New York City and followed them for an average of 28 days per subject. The sulfur tracer method was used to estimate infiltration factors. Mixed proportional odds models for an ordinal response were used to relate daily cough and wheeze scores to indoor PM2.5 of indoor and outdoor origin and its components. Results: The odds ratio (OR) associated with being above a given symptom score for a standard deviation increase in indoor PM2.5 of outdoor origin (PMOS) was 1.26 (95% Confidence Interval: 0.90 – 1.76) for cough and 1.10 (0.73 – 1.66) for wheeze. Indoor PM2.5 of indoor origin (PMIS) was more strongly associated with wheeze (1.63 (1.11 – 2.39)) than cough (1.24 (0.92 – 1.68)). Odds of more severe cough were associated with indoor of outdoor origin components bromine (BrOS: 1.32 (1.05 – 1.67)), chlorine (ClOS: 1.27 (1.02 – 1.59)) and pyrolyzed organic carbon (OPOS: 1.49 (1.12 – 1.99)) year-round. Odds of more severe wheeze were most highly associated with the indoor of outdoor origin diesel-related organic carbon fraction (OC2OS: 7.46 (1.19 – 46.60)) in the winter. Conclusions: Indoor PM2.5 of indoor origin is more important for wheeze, while PM exposures of ambient origin appear to be more important for cough in asthmatic children.

Abstract Number	**P-2-20-28**
Presenter	Denis Gauvin*, Daniel Aubin, Pierre Lajoie, Véronique Gingras, Jean-Marc Leclerc, Marilène Courteau, Suzanne Gingras, Doyun Won, Don Fugler, Hans Schleibinger
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

The IVAIRE Project - Ventilation Characteristics of Single Family Homes of Asthmatic Children Followed in an Asthma Clinic

Background and Aims The IVAIRE study evaluated the impact of improved residential ventilation on IAQ and the frequency of asthma symptoms in children. This paper describes the pre-intervention phase of this study where the ventilation characteristics of the single family homes were analyzed in order to select the homes participating in the ventilation intervention. Methods Between October 2008 and June 2010, 111 children were selected and their homes were visited three times by trained technicians during the heating-season (fall and winter) and summer. During these visits the ventilation rates were measured and the mechanical ventilation system (MVS) and their use were characterized. The measured ventilation parameters were the air changes per hour (ACH) measured with PFT gas, the building airtightness (ACH50) with a blower door, CO2, and relative humidity (RH). Ventilation parameters were compared according to the presence/absence and the type of MVS. Results A MVS was present in 73 of the 111 homes, of which 44 were heat recovery ventilators (HRV) and 29 had mixing boxes. There was no difference in ACH between the homes with (0.22) or without (0.20) a MVS (p=0.53). However, the ACH50 was lower in the homes with a MVS than without (3.1 vs. 4.8, p=<0.0001) as well as RH (37.6 vs. 42.3%, p=0.0009). Moreover the homes with an HRV had a higher ACH (0.25 vs. 0.18, p=0.003) and a lower RH (35.8 vs. 40.4%, p=0.002) than the homes with a mixing box. Conclusions Even though in the homes with a MVS an HRV seems to be more effective than a mixing box, the ACH remained lower than the ASHRAE recommended guideline of 0.35 h-1. This indicates that the presence of a MVS alone may not guarantee adequate ventilation. Factors such as the capacity of the ventilation unit, proper installation and utilization by occupants need to be investigated to design specific corrective interventions tailored to each home.

Abstract Number	**P-2-20-29**
Presenter	Woo Kyung Kim*, Young-Wook Lee, Hae-Sun Yoon, Sujin Park, Chan Woo Park
Exposure	others
Health domains	allergies
Type of research	cross-sectional study

The prevalence of allergic diseases and allergic sensitization among urban office workers and forest service workers

Background: Asthma, allergic rhinitis (AR), and atopic dermatitis (AD) are the most prevalent allergic diseases and number of studies has shown an increase in prevalence of both all over the world in recent years. Although little about the prevalence of asthma, AR, and AD in Korean adults. And the incident sensitization to common allergens in the setting of sensitization to an occupational allergen has not been described. Aim: Our aim was to determine the prevalence of living and working place in adults. And also, determines the sensitization to common allergens in subjects with incident sensitization to a work-related allergen. Methods: A modified International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was used to survey from two areas in Korea between September and October, 2012. We performed questionnaire survey and allergy skin prick test with 27 common inhalant allergens among 276 subjects (response rate, 100%, n=276) age 21-54 years in Seoul and forest service workers. One hundred five subjects were forest service workers and 171 subjects were urban office workers. Results: The mean age was 33.7 ± 7.6 years. There were 117 man and 159 women. A history of asthma was noted in 7.2% and a history of AR was noted in 30.4%. And a history of AD was noted 9.3%. The each group of sensitization to allergen were 51.5% (urban) and 38.1% (forest), (p=0.038). The most common allergen was mites. The sensitization to cat allergen were more high in urban office workers (p=0.005). Conclusion: The prevalence of allergic rhinitis in urban areas was high. And urban officer workers were also high with sensitization rate compare to forest workers. The interesting results were the pollen sensitization rate in urban areas showed higher tendencies. More research will be needed in futures.

Abstract Number	**P-2-21-01**
Presenter	Anna Mölter*, Stephen Keevil, Martie van Tongeren, Stuart Crozier, Hans Kromhout, Penny Gowland, Frank de Vocht
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure measurement

Personal exposure to static and time-varying magnetic fields during MRI procedures in clinical practice in the UK

Background: Medical diagnosis using Magnetic Resonance Imaging (MRI) is the main source of exposure to high static magnetic fields in humans. Extensive safety protocols have been developed to ensure safety of patients and personnel. However, it remains unknown to what intensities of magnetic fields personnel routinely working with MRI systems in healthcare settings are exposed. Aims: The aims of this study are: to measure personal exposure levels of personnel routinely working with MRI; to compare exposure levels with newly proposed EU guidelines; and to identify factors related to increased or decreased personal exposure. Methods: The study population consists of radiographers, nurses/radiography helpers, anaesthetists and 1-3 unexposed controls recruited at 10 hospitals across the UK. Personal exposure is measured during multiple work shifts using a novel magnetic field dosimeter, clipped to a waist belt. The dosimeter simultaneously records the static magnetic field (Bx,y,z) and temporal changes in the static magnetic field (dBx,y,z/dt) in all three orthogonal directions (x,y,z) with a temporal resolution of 50Hz and 8kHz. Prior to the exposure measurements participants completed a baseline questionnaire. On the day of the measurements, participants also completed a work diary, documenting procedures and the time they spent in the scanner room. Results: Data collection is currently ongoing and data have not been analysed yet. To date 34 participants have been recruited at five sites and 40 measurements have been collected. Preliminary findings will be presented at the conference.

Abstract Number	**P-2-21-02**
Presenter	Rachel Grashow*, Jinming Zhang, Shona C. Fang, Marc G Weisskopf, David C. Christiani, Jennifer Cavallari
Exposure	metals
Health domains	no health domain
Type of research	exposure measurement

Toenail metals as a biomarker for metal exposures in welders

Background and aims: Toenail metal concentrations may capture exposure to welding fume components. We sought to identify the association between toenail metal and previous work activity, including specific exposure time periods of interest for individual metals. Methods: Forty-eight participants recruited through a welding school provided 69 toenail samples. Union-supplied personal work histories were confirmed by each subject. Toenails were analyzed for lead (Pb), manganese (Mn), cadmium (Cd), nickel (Ni) and arsenic (As) using ICP-MS. Spearman correlation coefficients were used to examine the correlation between toenail metals. Using mixed models to account for multiple participation times, we investigated whether hours welded—a simplified occupational exposure measurement broken into three month intervals—correlated with log-transformed toenail concentrations of Pb, Mn, Cd, Ni and As. Results: Highest concentrations were found for Ni, followed by Mn, Pb and As, and Cd. All metals were significantly correlated with one another (rho range=0.28-0.51), with the exception of Ni and As. After adjusting for age, smoking and BMI, toenail Pb was associated with hours welded over the entire year (p=0.01). Cd was associated with hours welded over the previous 7-9 months (p = 0.03), and also the entire year (p=0.02). Lastly, toenail Mn levels were associated with hours welded 7-9 months prior to clipping (p=0.003). Conclusions: Results suggest toenail Mn, Pb and Cd may reflect work activity across particular time intervals. Overall, toenails may serve as useful biomarkers for occupational metal fume exposures to Mn, Pb and Cd during distinct periods over the year prior to sample collection.

Abstract Number	**P-2-22-01**
Presenter	Maria Altomare, Margherita Ferrante*, Maria Fiore, Matteo Zuccarello, Alfredo Mazzarino, Filippo Giacone, Rosita A. Condorelli, Lucia O. Vicari, Sandro La Vignera, Aldo E. Calogero, Enzo Vicari
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	others

RELATIONSHIP BETWEEN BLOOD AND SEMINAL PLASMA PCB LEVELS AND ABNORMALITIES OF SPERM PARAMETERS IN MEN LIVING IN A NON-INDUSTRIAL AREA OF CENTRAL SICILY

Background: Polychlorinated biphenyls (PCBs) are industrial toxicants, banned by most countries several decades ago, highly persistent and ubiquitous. Several studies suggest that PCB may have a negative impact on sperm quality and sperm DNA integrity. Aims: To evaluate whether alterations of spem parameters may relate to the presence of PCB in blood (B) and in the seminal plasma (SP), even in an area without industrial contamination. Methods: We recruited 83 men with an age range of 21-46 years, living in Regalbuto, a rural area of Central Sicily (Italy). Blood and seminal plasma PCB concentrations were measured by gas-chromatographic technique with electron capture detector (ECD) and confirmed by the reading of the congeners present in a double column. Conventional sperm parameters were evaluated according to the WHO 2010 guidelines. Non-conventional parameters were assessed by flow-cytometry. Results: Median levels of all congeners were higher in SP vs. B (1.2 vs. 0.2 µg/L). The most represented congeners (105 in B; 187 in SP) were both dioxin-like PCBs. The best studied congeners (118; 153) were found in a relevant percentage of men, both in B (14.4%; 45.8%) and in SP (13.2%; 4.8%). Two dioxin-like congeners (126; 169) with higher toxic equivalent factor (TEF) were also detected, both in B (8.4%; 9.6%) and in SP (6%; 3.6%). Asthenozoospermia, sperm concentration decrease, and teratozoospermia were found, respectively, in 37.4%, 20.5%, and 6.0% of men. 31.3% of men had a high percentage of spermatozoa with low mitochondrial membrane potential, and 22.9% of men had a high percentage of spermatozoa with an abnormal chromatin compactness. A high percentage of spermatozoa with DNA fragmentation was found in 9.6% of men. Conclusions: Our results showed that PCBs are also detectable in so-called pristine environment, such as a rural area. These persistent organic pollutants may play a role in altering male fertility parameters.

Abstract Number	**P-2-23-01**
Presenter	Thuy Lam*, Paige Williams, Susan A. Korrick, Mary Lee, Jane Burns, Linda Birnbaum, Oleg Sergeyev, Boris Revich, Larisa M. Altshul, Donald Patterson Jr, Russ Hauser
Exposure	pesticides
Health domains	other
Type of research	cohort study

Age at Sexual Maturity and Organochlorine Exposure among Russian Boys

Background: Few human studies have evaluated the impact of childhood exposure to organochlorine pesticides (OCP) on sexual maturity, especially in boys. Aims: To evaluate the association of serum OCP concentrations [hexachlorobenzene (HCB), β-hexachlorocyclohexane (β-HCH), and p,p-dichlorodiphenyldichloroethylene (p,p'-DDE)] with sexual maturity among boys in Chapaevsk, Russia, a town with environmental contamination from organochlorine compounds. Methods: 499 boys were recruited at ages 8-9 years in 2003-2005 from Chapaevsk, Russia and followed prospectively for 7 years. At entry, 350 boys had serum OCPs measured. Sexual maturity was defined as testicular volume ≥20mL, or Tanner stage 5 for genitalia (G) or pubic hair (P). We used multivariable interval-censored models to assess the associations of serum-lipid adjusted quartiles of OCPs with physician-assessed sexual maturity rating. Results: Median (25th, 75th percentile) for concentrations of serum HCB, β-HCH, and p,p'-DDE concentrations at study entry were 154 (106, 242), 165 (110, 261), and 286 (187, 481) ng/g lipids, respectively. At the last exam, 69%, 49%, and 22% attained TV ≥ 20mL, G5, and P5 sexual maturity, respectively. Later age of maturity was observed for higher β-HCH for all pubertal outcomes. For example, mature testicular volume was achieved 4.3 months (95% CI: -0.4, 9.0), 5.2 months (95% CI: 0.4, 9.9), and 7.0 months (95% CI: 2.1, 11.8) later for quartiles 2, 3, and 4, respectively compared to quartile 1 of β-HCH (trend p: 0.01). Later sexual maturity by P5 was also observed for HCB and p,p'-DDE. For HCB, P5 was attained 6.8 months (95% CI: -0.3, 14.0), 10.0 months (95% CI: 2.4, 17.5), and 7.6 months (95% CI: 0.3, 14.9) later for quartiles 2, 3, and 4, respectively compared to quartile 1 (trend p: 0.02). Conclusions: Higher serum OCP concentrations measured in boys at 8-9 years of age were associated with a later age of attainment of sexual maturity measures.

Abstract Number	**P-2-23-02**
Presenter	Erik Petersen*, Stefan Gartiser, Susanne Smolka, Barbara Jahn, Stefanie Wieck
Exposure	pesticides
Health domains	other
Type of research	others

Alternatives to biocides – a contribution to a healthier indoor environment

Background Biocidal products contain active substances for the control of organisms that are harmful to human or animal health and for the control of organisms that cause damage to natural or manufactured products or are simply annoying. The various and sometimes incorrect or even needless use is one of the most abundant source of indoor pollutants in the private sector. Aims The obligation to inform the public about alternatives and precautionary measurements was included in the German Chemical law in order to minimize the use of biocidal products. This was the cause to develop an information system for costumers and multipliers with a new web portal and additional print products as the focal point. The new portal wants to raise the risk awareness of the public when they handle with biocidal products and to encourage the acceptance of the use of less harmful or harmless alternatives and preventive measurements. Methods In July 2010 the Federal Environment Agency has launched the portal www.biozid.info, which is regularly actualized and extended. The portal contains information about the different application areas (product types) of biocidal products, their use and alternatives and also a special inventory of different pests. Results We present results of the statistical evaluation of the users' access of the portal over the years. They highlights the demand and interest of the visitors. The demand shows a specific course over the year with regard to the number of visits and the search items. Conclusions For the further implementation it is necessary to improve the attractiveness and usability of the portal. To expand the accessibility one also has to take into account other media such as the old style print media but also new social media, apps, podcast and video (Cross-Media-Strategy).

Abstract Number	**P-2-23-03**
Presenter	Cynnie Curl*, Richard Fenske, Chensheng Lu, Jennifer Nettleton, Joel Kaufman
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Assessment of dietary exposure to organophosphorus pesticides using food frequency questionnaires and information on organic food consumption habits

Background. Consumption of organically grown food has been shown to result in significant reductions in organophosphate (OP) pesticide exposure in non-occupationally exposed populations, and 40% of Americans consume organic food at least occasionally. Aims. The purpose of this study was to assess dietary exposure to OP pesticides based on data from food frequency questionnaires (FFQ) and information on organic food consumption habits, and to empirically compare those exposure assessments with measurements of urinary OP pesticide biomarkers. Methods. Dietary exposure to OP pesticides was assessed in 800 participants in the Multi-Ethnic Study of Atherosclerosis (MESA) in two ways:1)by measurement of urinary dialkylphosphate (DAP) concentrations, and 2)by multiplying average dietary intake of each of 20 food items by average residue levels of each of 10 OP pesticides in those items, and summing across foods and pesticides. Dietary intake was based on individual FFQ responses, and residue levels were obtained from the USDA's Pesticide Data Program. Participants were categorized as "often or always", "sometimes" or "seldom or never" consumers of organic food, based on self-report. Results. In preliminary analysis, we observe a significant linear relationship between predicted dietary exposure and DAP levels in participants who reported seldom or never consuming organic foods (R2=0.71). No relationship was observed between FFQ-based exposure predictions and DAP measurements for participants who reported that they sometimes, often or always consumed organic food. DAP levels in participants who reported at least occasional consumption of organic food were significantly lower than those who do not, after adjustment for food intake. Conclusions. This work suggests that OP pesticide exposure can be predicted using FFQ and residue data for people who do not consume organic diets. These data also support previous research demonstrating that consumption of organic food is associated with lower urinary DAP concentrations.

Abstract Number	**P-2-23-04**
Presenter	Mariana Guimarães*, Michele Cunha, Daniele Carvalho, Tatyana Sampaio, Lourdes Martins, Alfésio Braga, Luiz Pereira
Exposure	pesticides
Health domains	reproductive outcomes
Type of research	cross-sectional study

Association between living near industrial landfill and miscarriage in São Vicente, SP, Brazil

Background: Living near contaminated areas with chemicals represents a greater risk to health. According to the Environmental Company of São Paulo State, in São Vicente mainland region there are five areas of irregular landfill from a fertilizer and organochlorine compounds industry, which polluted the soil, subsoil and groundwater with halogenated solvents, phenols, biocides and persistent organic pollutants. Contaminated areas with these chemicals are sources of high risk for population, mainly due to its high toxicity, persistence and bioaccumulation. Living in areas with high levels of industrial pollution has been associated with higher miscarriages rates. Aims: Evaluate spatial distribution of miscarriages in São Vicente mainland region. Methods: We adopted a cross sectional study. A structured questionnaire was applied to a population sample of 223 childbearing age women who became pregnant between 2001 and 2006 in São Vicente mainland region. A spatial analysis was carried out by GIS, using a GPS receiver to collect geographical coordinates. Buffers with a 1 km radius were constructed from the center points of each industrial landfill mapped. Fisher's exact test was used to statistical analysis between miscarriage occurrences and living inside or outside buffers. A 5% significance level was adopted. This study was part of a larger project in estuary region in southeastern Brazil. Results: During the studied period, of 43 women who suffered miscarriage, 25 were living within buffers, and 18 lived outside it. Among 180 women who did not suffered miscarriage, 100 were living within buffers and 80 outside it. There were no association between miscarriage and lived inside or outside buffers ($p>0.05$). Conclusions: Although 58% of childbearing age women who suffered miscarriage lived within a 1 km radius of landfill sites in São Vicente mainland region there were no associations. Studies with different spatial approaches should be made in the region.

Abstract Number	**P-2-23-05**
Presenter	Adalberto Luiz Miranda-Filho*, Rosalina Koifman, Sergio Koifman, Gina Torres Monteiro
Exposure	pesticides
Health domains	cancer
Type of research	time series study

BRAIN CANCER MORTALITY IN AN AGRICULTURAL REGION, RIO DE JANEIRO STATE, BRAZIL: A POPULATION-BASED AGE-PERIOD-COHORT STUDY

Background: Brain cancer etiology has been poorly understood. Several studies indicate that residents in agricultural regions have an increased mortality risk. Aims: To explore an age-period-cohort effect study on brain cancer mortality in Serrana Region, an agricultural area in Rio de Janeiro State, Brazil. Methods: This was a descriptive epidemiologic study of mortality brain cancer in residents > 19 yr. either performed at an agricultural (Serrana Region) or a non-agricultural one (Metropolitan Region) during 1996 -2010. Trend analysis was carried out using Joinpoint regression, and the age-period-cohort effects ascertained using log-linear Poisson regression. Results: The estimated brain cancer mortality annual percentage change in Serrana Region was 3.8% (95% C.I. 0.8 and 5.6), while - 0.2 (95% C.I. -1.2 -0.7) at the Metropolitan Region. In the former, a cohort effect was observed with increased mortality risk ratios, MRR: comparatively to those born in 1945-49, men born in 1980-84 presented a MRR= 4.07 (95% C.I. 1.83-9.04), and those born in 1985-89, a MRR = 4.17 (CI95% 1.79 – 9.74). Increased risk ratios were not observed in the Metropolitan Region, while an age effect was observed in both areas. Conclusion: These findings support the hypothesis that residents in agricultural regions may have experienced an increased exposure to brain cancer risk factors. The observed cohort effect is suggestive that environmental exposures, such as pesticides and biological agents, among others related to rural activities, may represent important risk exposures involved in brain carcinogenesis.

Abstract Number	**P-2-23-06**
Presenter	Peter Fantke*, Brenda Gillespie, Ronnie Juraske, Olivier Jolliet
Exposure	pesticides
Health domains	other
Type of research	others

Characterizing and estimating pesticide degradation in food crops

Background. Dissipation half-lives are an important driver for fate behavior of pesticides in food crops, but also among most uncertain parameters in exposure models. Hence, a proper estimation of half-lives in crops is required, but still not available. Aims. We aimed at providing a consistent framework for estimating pesticide half-lives in food crops for use in modeling approaches applied in human exposure assessments. Methods. We first build a database of 4518 measured pesticide dissipation half-lives, of which 41% have been measured in the last 5 years, mostly in Asia. Second, we determine the influence of temperature using a subset of 1011 data points with reported temperatures. Third, we calculate recommended geomean values of half-lives at 20°C and standard deviations on their log for 330 pesticides and 44 crops, using multiple imputations for missing temperatures. We finally propose a regression-based model to predict half-lives for other pesticides as a function of temperature, substance class, chemical properties and crop type. Results. Temperature is the major determinant of the variability of measured half-lives for a given pesticide. When temperature was also reported, the regression model is able to explain 69% of the variability as a function of crop, temperature and substance. Considering all data available, the model still explains 46% of the variability. Interestingly, the range of recommended geomean half-lives is relatively narrow, with the 2.5th and 97th percentiles across pesticides ranging from 0.9 to 21 days. Results of the predictive model show that when temperature is known, 56% of half-life variability can be explained by temperature, crop type, substance class, Kow and Koc. When substance class and crop are not considered in the model, the R^2 is reduced from 0.56 to 0.30 with molecular weight becoming significant. Conclusions. Our research has important implications for human exposure assessment, especially since food crop consumption is the predominant exposure pathway of the general public towards pesticides

Abstract Number	**P-2-23-07**
Presenter	Jun Ueyama*, Hiroshi Nomura, Isao Saito, Takaaki Kondo, Yuka Sugiura, Katsuyuki Murata, Toyoto Iwata, Masahiro Gotoh, Shinya Wakusawa, Michihiro Kamijima
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Concentration distribution of urinary pyrethroid insecticide metabolites in Japanese workers

Urinary pyrethroid (PYR) metabolites such as 3-phenoxybenzoic acid (3PBA) and chrysanthemumdicarboxylic acid (CDCA) have been used as the most sensitive biomarker for PYR exposure. The purpose of this study was to reveal the distribution of urinary PYR metabolite concentrations in Japanese workers. Urine samples were collected in both summer and winter seasons from 260 Japanese adults who worked as food distributors (FD, n=92), apple farmers (AF, n=144) or pest control operators (PCO, n=24). FD is regarded as a representative population exposed to PYRs at environmental background levels. 3PBA and CDCA were measured by gas chromatography-mass spectrometry. Logarithmically transformed PYR metabolites were used for all statistical analyses. High detection frequencies of CDCA and 3PBA were observed in both seasons (more than 92%). The geometric mean values (GSD) of 3PBA in summer and winter were 0.7 (2.3) and 0.5 (2.5) for FD, 0.9 (2.7) and 0.4 (3.1) for AF, and 2.6 (2.9) and 1.8 (3.1) µg/g creatinine for PCO, respectively. Those of CDCA were 0.33 (3.9) and 0.13 (3.1) for FD, 0.30 (4.1) and 0.21 (3.0) for AF, and 0.56 (3.4) and 0.26 (2.9) µg/g creatinine for PCO, respectively. Significant seasonal differences (summer > winter) in both metabolites were found in all the groups except for 3PBA in PCO ($p<0.05$), suggesting that PYR exposure level in summer might be higher than in winter regardless of occupations. Concentrations of 3PBA in PCO were significantly higher than those in other groups in both seasons. On the other hand, differences of urinary CDCA concentrations were not found among the three groups, indicating that there was no occupation-related exposure to PYR, which are metabolized into CDCA, in AF and PCO. Results of our preliminary analysis about the relationship between urinary CDCA and indoor use of its parent compound PYR in FD indicates the possibility that one of PYR exposure sources in general populations may be vapor of PYR insecticides used for mosquito and fly control.

Abstract Number	**P-2-23-08**
Presenter	Elodie Faure*, John R. Nuckols, Jeffrey Blain, Rémi Béranger, Virginie Chasles, Joachim Schüz, Béatrice Fervers
Exposure	pesticides
Health domains	cancer
Type of research	health impact assessment

Development of GIS based indicators to assess exposure to agricultural pesticides in France

Background: There is growing trend in use of GIS in health risk analysis. A number of studies have used GIS to assess proximity to crop production and environmental pesticides exposure. However, most of these studies lacked spatial information on known factors such as wind direction, and barriers to transport from field to receptor. France, with publicly available spatial data on these critical factors presents a unique opportunity to advance understanding the relationship between proximity to crop production and residential pesticides exposure. Aim: SIGEXPO is a pilot study in the Rhone-Alpes Region for developing and validating a metric for an epidemiological study concerning exposure to agricultural pesticides across France. Methods: For 239 homes in 3 differing agriculture territories, we developed a GIS taking into account the residential proximity to pesticide source areas (fields), meteorological data, and mapped vegetative, topographic, and structural barriers between homes and fields. We linked crop, pesticide use, and transport factor data to create an exposure metric based on mechanisms of pesticide drift. We collected and analyzed house dust samples from each home representing short (30 days) and long-term deposition of pesticides for use in calibrating and validating of our metric. Results: We will present 1) Our methodology for combining data layers of the above factors to create potential pesticide transport area for each residence based on prevailing wind direction, 2) Probability of detection/ relative level of pesticides expected to be captured by the samplers in each home over a 30 day period during the 2012 growing season, and 3) Results of our validation based on pesticides in house dust samples. Conclusions: We have demonstrated the ability to construct and assess a metric for environmental pesticides exposure in epidemiological studies across France.

Abstract Number	**P-2-23-09**
Presenter	Shahbaz Ahmad*, Hafiz Azhar Ali Khan
Exposure	pesticides
Health domains	healthrelated quality of life
Type of research	health impact assessment

Efficacy of Different Insecticides against the Sugarcane Stem Borer (Chilo infuscatellus, Pyralidae Lepidoptera) In Punjab, Pakistan

The experiment was conducted to find out the effect of insecticides against the sugarcane stem borer (Chilo infuscatellus). The experiment was laid out in an RCBD and replicated thrice with a plot size of 5×10 m2 with five treatments in each block. Four insecticides viz, ,Furadan 3G Carbofuran @12 kg/acre, Thimet @5G Phorate @ 10 kg /acre, Padan 4G Cartap @ 10 kg/acre and Monomehypo @ 8kg/acre were applied with a check for comparison.The results showed a significant difference among the treatments and the means were compared by Tukey HSD test which showed that the minimum increase in infestation 10.22% after the treatments with Furadan followed by Thimet, Padan and Monomehypo which showed 11.35%, 12.45% and 13.84% increased infestation respectively. Maximum infestation (26.13%) was observed in control treatment.

Abstract Number	**P-2-23-10**
Presenter	Hinde Hami*, Tidiane Diallo, Fatima-Zahra Azzaoui, Ababacar Maïga, Abdelrhani Mokhtari, Rachida Soulaymani-Bencheikh, Abdelmajid Soulaymani
Exposure	pesticides
Health domains	other
Type of research	others

Epidemiology of acute pesticide poisoning in Mali

Background: The unsafe use of pesticides represents a problem for human health in both developed and developing countries. Aims: This study was conducted to describe the main characteristics of acute pesticide poisoning in Mali. Methods: This is a retrospective analysis of pesticide poisoning cases, recorded between 2000 and 2010, in the medical records and the consultation register at 15 hospitals in Mali. Results: There were 124 cases suffering from acute pesticide poisoning in Mali, which was 4.1% of all poisoning cases reported during the study period. Of these, 33% were under the age of 15 years. The average age of victims was 22±17 years. Nearly 89% of reported cases resulted from oral exposure, 10.5% from inhalation and only 0.8% from dermal exposure. The risk was mainly related to the use of organophosphates. According to recorded data, pesticides were used as a means of suicide in 17,7% of cases. The poisoning symptoms were varied, depending on the characteristics of the product and type of exposure. Among all diagnosed cases, 8.1% died. Conclusions: Many situations involving pesticide exposure are linked to education and certain socio-economic conditions. These conditions tend to occur more often in developing countries. Preventive measures should be taken to rationalize pesticide use.

Abstract Number	**P-2-23-11**
Presenter	Maartje Brouwer*, Anke Huss, Roel Vermeulen, Hans Kromhout
Exposure	pesticides
Health domains	no health domain
Type of research	exposure modeling

Estimating environmental pesticide exposure in the Netherlands using geo-spatial information and data on pesticide application practices

Background: Pesticides have been associated with several health effects. Drift of pesticides from their application sites can result in exposure in neighboring residential areas. GIS-based methods will have to be developed to estimate environmental exposure to pesticides. We aimed to determine the feasibility of estimating use of agricultural pesticides in the vicinity of residences in the Netherlands, by combining residential locations with spatial information on agricultural land-use and pesticide application practices. Methods: 1321 enrollment addresses were obtained from a national Parkinson's Disease case-control study (484 cases, 837 controls). The addresses were linked to a recent land-use map (available for 2000) and the cultivated area of 6 agricultural classes (cereals, maize, potatoes, beets, bulbs, orchards) within 25, 50, 100, 500 and 1000m buffers around the addresses was determined. Data on pesticide use in 2000 was obtained from national pesticide surveys among famers and total kilograms of individual pesticides applied within the defined buffers was estimated. Results: Of the residential addresses 99.4% could be geocoded at building-level (n=1313). Arable land was present within 100m distance of 14% of the residences, with maize being the most prevalent crop. High volume fungicides like mancozeb (use on potatoes and bulbs) and captan (fruit) were dominant in terms of total kilograms applied in vicinity of the residences. Conclusions: We conclude that it is feasible to obtain and combine data on recent agricultural land-use and crop specific pesticide applications in the Netherlands, and estimate pesticide use in the vicinity of residences as a proxy for environmental exposure. Historical (before mid-90s) information on land-use and pesticide applications is less detailed, which will inherently result in more uncertainty in the estimates. More work is needed to extend this method to retrospectively assess cumulative lifetime environmental exposure to pesticides for participants in epidemiological investigations.

Abstract Number	**P-2-23-12**
Presenter	Rachel Raanan*, Elliot Berry, Ya'acov Ritov, John Young
Exposure	pesticides
Health domains	equity
Type of research	exposure modeling

Exposure Measures Addressing Pesticide Exposure and Nutritional Adequacy

Exposure Measures Addressing Pesticide Exposure and Nutritional Adequacy Background: Estimating association between diet and chronic disease may gain from focusing on dietary patterns (as opposed to single measures) and integrating variables related to both nutritional adequacy (vitamins, etc.) and contaminant exposure (for example, peeling). Aims: Identifying dietary variables that have potential effect on BOTH nutrition adequacy and pesticide exposure and evaluating their distribution across different demographic and temporal variables. Methods: Representative sample of n=3,246 Arabs and Jews adults. 24h recall (additional recall on 42%) with detailed information on food processing was implemented. Data mining tools, MANOVA, STEP regressions, and GLM were used. Results: The following diet patterns, potentially affecting both pesticide risk and nutrition were tested: variety of foods consumed; fresh fruits and vegetables (variety, amount consumed and peeling). Large variations in the distribution of these variables across different socio-demographic groups were identified. Druze women consumed the lowest food variety-66% compared to Jewish women (12.8 95% CI 11.7, 14.0; 19.2 95% CI 18.8, 19.5). Tradition/culture and ethnicity had significant association with variables associated with pesticide residuals in food. For example- even when adjusted for household income the Arab variety score was lower than that of Jews, as was frequency of peeling (6%, p value=0.000). Conclusions: Including diet patterns corresponding to both quality and risk can guide intervention efforts, focus research, and be used in exposure models. Ethnicity and culture factors should be included in such analyses. Keywords: exposure assessment, dietary patterning, ethnicity, pesticides, contaminants, nutrition.

Abstract Number	**P-2-23-13**
Presenter	Nosiku Munyinda*
Exposure	persistent organic pollutants
Health domains	neurodevelopment
Type of research	exposure measurement

i. "An Analytical Chemistry Approach to understanding a Public Health Problem: Exposure Assessment of DDT in selected recently exposed communities of Zambia";

In Zambia, malaria accounts for 36% of all hospital cases mostly pregnant women and children. With the increase of cases a private mining company re-introduced DDT in 2000 in two mining Districts of Zambia. The apparent success led the Zambian government to initiate IRS activities in five districts. This increased to 15 and plans were underway to scale it up to 56 districts directly exposing more than 8 million people to DDT. 246,000 kgs of DDT have been brought into Zambia since 2000 and applied in people's homes. There have been no studies carried out to ascertain its fate in the environment and human health. The general objective of this study is to quantify recent DDT exposure and study neurodevelopment outcomes in children of selected communities in Zambia. The United States Environmental Protection Agency (EPA) Method 8081B was used for sample collection, extraction and analysis. Soil samples were collected from top soil at a depth of 2-5 cm placed in a khaki paper which was put into a plastic bag. Sample preparation was done using the QUECHERS kits. The analyte was lastly transferred to sample vials which were finally taken for analysis. The Agilent Triple Quadrupole GC/MS system was used for analysis. Validation was done and retention times recorded. The Limits of Detection (LoDs) ranged from 0.034 to 0.04ppm with recoveries from 86.8% to 91.6%. The results obtained show that there is DDT and its metabolites present in the top soil of these residential areas. This ranged from 0.19-5.8 ppm 1.13-13.94 and 2.35-41.16ppm for DDT, DDE and DDD respectively. The results for the water analysis are currently being worked on but are envisaged to be ready by the end of March, 2013. This study has bridged a knowledge gap in that there is evidence that DDT is present in the soils. Lastly, this study is the first phase of a larger cohort study which will look at trends and possible associations between this exposure to DDT and its metabolites both in-utero and post natal and neurodevelopmental outcomes in children of the same selected areas of Zambia.

Abstract Number	**P-2-23-14**
Presenter	Zeyan Liew*, Anthony Wang, Jeff M. Bronstein, Beate Ritz
Exposure	pesticides
Health domains	neurodegeneration
Type of research	case-control study

Job Exposure Matrix (JEM) derived estimates of life-time occupational pesticide exposure and the risk of Parkinson's Disease

Background: Previous studies repeatedly suggested that Parkinson's disease (PD) is associated with occupational pesticide exposure, but in many studies exposures were self-reported and none adjusted for concomitant ambient pesticide exposures. Objective: To investigate whether occupational exposure to pesticides increases the risk of PD in California's heavily agricultural region. Methods: We enrolled 357 incident PD cases and 750 population controls in a case-control study in California's Central Valley between 2001 to 2011. A comprehensive Job Exposure Matrix (JEM) was developed to assess participant's life-time cumulative occupational pesticide exposure based on work history and detailed job tasks information. Results: PD risk was estimated to be more than 2-fold higher (OR=2.19 95%CI 1.26, 3.82) in men who were classified as highly occupational exposed with our data suggesting an exposure-response (trend p=0.007). Farming tasks with more direct and intense pesticide exposures such as applying, spraying and mixing of pesticides resulted in greater risks than indirect exposures from general tasks such as planting, harvesting, packing, sorting, etc. Results did not change when we adjusted for residential and occupational ambient pesticide exposures estimated based on a Geographic Information System (GIS) model. Conclusion: We provide further evidence that occupational pesticide exposure increases the risk of PD in men and ambient exposures did not confound these associations.

Abstract Number	**P-2-23-15**
Presenter	Kimberly Paul*, Shannon L. Rhodes, Janet S. Sinsheimer, Myles Cockburn, Jeff M. Bronstein, Beate Ritz
Exposure	pesticides
Health domains	neurodegeneration
Type of research	case-control study

NOS genes and PD: Marginal associations and gene environment interactions with pesticides

Background: Nitric oxide (NO) produced by nitric oxide synthase (NOS) enzymes is a potent pro-oxidant that can damage dopaminergic neurons. Thus, the NOS genes are candidates for Parkinson's disease (PD). Organophosphates (OPs) are widely used agricultural and household pesticides that can induce oxidative stress and have been previously associated with PD. We investigated the contribution of genetic variation in the NOS genes to PD risk alone and in combination with OP pesticide exposure. Methods: In 357 incident PD cases and 495 population controls from Central California, we investigated 10 single nucleotide polymorphisms (SNPs) under an additive genetic model for association with PD; and considered gene-environment interactions for NOS1 rs2682826 with self-reported household OP use and computer-modeled ambient OP exposure. Results: Replicating previous findings, we estimate 1.6-2 fold increases in PD risk for variant allele carriers of NOS1 rs1047735, NOS2 rs1060826 and NOS2 rs2255929. Additionally, we replicate the interaction between NOS1 rs2682826 and any household pesticide use (Odds ratio (OR)=1.75, 95% Confidence Interval (CI)=0.98-3.12). When we limit to subjects reporting household OP pesticide use, we estimate a stronger interaction (OR=2.47, 95% CI=1.13-5.41). Specifically, there was no effect of the genetic variant in subjects unexposed to household OPs, yet when a subject was exposed to OPs the variant T allele was associated with an increased risk of PD beyond that observed for the CC genotype (ORCC+OP =1.35, 95% CI=0.77-2.36 vs. ORCT/TT+OP=2.61, 95% CI=1.45-4.71). We also found risk increases for high ambient OP exposure (ORCC+OP =2.09, 95% CI=1.18-3.71 vs. ORCT/TT+OP=3.35, 95% CI=1.79-6.30). Results did not change when we mutually adjusted for household pesticide use, ambient exposures and occupational exposures to pesticides. Interpretation: Our findings support NOS1 and NOS2 as risk factors for PD and NOS1 rs2682826 as a modifier of OP associations with PD.

Abstract Number	**P-2-23-16**
Presenter	Yehoshua Maor*, Ora Paltiel, Zvi Roth, Benny Chefetz
Exposure	persistent organic pollutants
Health domains	healthrelated quality of life
Type of research	exposure measurement

Novel biomonitoring method for residues of carbamazepine in the agro-environment.

Background Pharmaceutical residues, a class of contaminants of emerging concern, are discharged in wastewaters, which after treatment are used in irrigation. Some pharmaceutical residues, including persistent organic pollutants (POPs), are thus introduced to the agro-ecosystem with the potential of entering the food-chain and affecting human health. Carbamazepine (CBZ), an anticonvulsant drug, has been proposed as an antropogenic marker due to its ubiquitous presence in the environment. Analytic methods for CBZ have been developed for wastewaters and surface waters; however no previous work has been conducted in environmental concentration of its residues in different complex matrices such as urine, blood and other bodily fluids. Aim To establish an immunoanalytic method (i.e., ELISA) validated by LC/MS for determination of residues of CBZ in the agro-environment in different complex matrices enabling its use in eventual biomonitoring of CBZ.Using this method we can track exposure to CBZ not only via crops as previously published by our group, but also via meat and dairy consumption. Methods Urine and blood specimens were collected from treated cows and were analyzed by ELISA immunoassay. The analytical performance was compared to LC/MS after solid-phase extraction. Results CBZ and its stable metabolites were detected in both urine and plasma in ng/L level. ELISA results correlate well with the ones obtained by LC-MS/MS for CBZ and its metabolites. The methods correlation delineates CBZ metabolism and bioaccumulation in dairy cows. Conclusions The established method is reliable with high specificity for CBZ and its metabolites. The current method will facilitate more detailed evaluations of the potential toxicological significance of the detection of CBZ in the environment as it joins a growing list of compounds to be assessed in biomonitoring.

Abstract Number	**P-2-23-17**
Presenter	Sonia El-Zaemey, Jane Heyworth*, Lin Frtischi
Exposure	pesticides
Health domains	no health domain
Type of research	cross-sectional study

Occupational pesticide exposure among Yemeni women

Background: The nature and extent of pesticide exposure among women living in developing countries is likely to be different from women living in developed countries because of the differences in crops grown, nature of agriculture practices, education, behaviour, culture and the types and methods of pesticide use. However, few studies of pesticide exposure in females have been conducted in developing countries such as Yemen. Aims: The study aims to describe pesticide exposure among female agricultural workers living in Sana'a governorate and Sana'a city, Yemen. Methods: In this cross–sectional study a questionnaire was distributed to obtain information on pesticide exposure among 540 women who had a daughter enrolled in high school during 2011-2012. Women were asked about exposure before and after marriage. The change from being single to married may potentially lead to changes in the behaviours and type of work on the farm because of increases in household responsibilities after marriage. Results: Forty two precent of 410 women who returned the questionnaire reported working on a farm during their lifetime. Among these women the, 47% and 69% of women who reported working on a farm before and after marriage respectively indicated that pesticides were used on the farm where they worked. Among women who reported working on farms where pesticides were used before marriage, 45% reported not using any personal protective equipment, whereas 33% reported not using personal protective equipment after marriage. The most commonly pesticide reported to be used in the farms was the banned pesticide, dimethoate. Conclusions: The results of this study indicate that women working on farms in Yemen are likely to be exposed to pesticides. Hence, educational programs regarding the safety and use of pesticides and legislation promoting the use of safer pesticides is needed.

Abstract Number	**P-2-23-18**
Presenter	Aline Santos, Jaime Lima, Armando Meyer*
Exposure	pesticides
Health domains	neurodegeneration
Type of research	health impact assessment

PESTICIDE SALES AND PARKINSON DISEASE IN BRAZIL

Background: Pesticide exposure has been implicated in several environmental and health problems, including Parkinson’s disease (PD). Pesticide use in Brazil has increased so significantly in the last 2 decades that it is been considered the top consumer of these substances in the world. Aims: The present study aimed at evaluating the association between the per capita sales of pesticides was obtained from agroeconomic census performed in 1985 and 1996 and hospitalization rates by PD between 1997 and 2007. Methods: Data on every hospitalization by PD, between 1997 and 2007, were retrieved from Brazilian Hospitalization System, and used to estimate PD hospitalization rates in each of the 552 Brazilian micro regions. Spearman correlation tests were initially obtained to proceed investigation. Hospitalizations rates were obtained after analysing distribution patterns of pesticides consumption. Quintile distribution of exposure was used to compare rates obtained from all the Brazilian database, which was stratified by urban / rural microregions, gender and age. Results: Results showed associations between rural micro regions hospitalizations by Parkinson´s disease and the degree of pesticides exposure. Generally, we have observed that the higher level of pesticides exposure was accompanied with higher hospitalizations rates. This increasing risk association behavior was similar in magnitude for both gender and different age groups. These associations were not evident in urban areas, confirming a clear relationship between pesticides exposure in rural areas and adverse effects associated to Parkinson´s disease. Risk estimates were even higher in women, showing six times higher rates associated to the higher pesticide exposure quintile. Conclusions: In agreement with recent international evidences, our results suggest that pesticide exposure may increase the risk of PD. Other refined studies are needed to investigate this possible association found.

Abstract Number	**P-2-23-19**
Presenter	Jaime Lima*, Caio Del Esporti Menezes da Rocha, Armando Meyer
Exposure	pesticides
Health domains	cancer
Type of research	health impact assessment

Pesticides Exposure Associations with Cancer Incidence and Mortality: An International Health Study.

BACKGROUND: New strategies in epidemiological and toxicological research are needed for environmental and occupational health studies. One major concern about pesticides exposure is associated to the risk of cancer development. Several studies have shown consistent positive associations between pesticides exposures and non-Hodgkin lymphoma, leukemia, solid tumors, brain and prostate cancer. AIMS: The basis of our purpose in this study was the investigation of databases from international organizations such as FAO and IARC to retrieve information concerning pesticides use and cancer incidence and mortality all over the world and search for associations between pesticides exposure and cancer. METHODS: Information concerning pesticides use and consumption for all countries was retrieved at FAO and IARC files databases. For pesticides use we have established a timeline range of analysis from 1995 through 1998 and cancer incidence and mortality data were obtained at GLOBOCAN 2008. A total number of 102 countries were included in the study. Correlation analyses were performed for both total pesticides use or stratified by pesticides classes. Cancer incidence and mortality were outcome variables included in the correlation study. We have also planned linear regression modeling and risk ratios for interquartile comparisons. RESULTS: Overall, we have observed strong positive association (significant at the 0,01 level) between cancer incidence and total pesticide use (r2=0,870), or stratified by classes: insecticides (r2=0,888), fungicides (r2=0,505), herbicides (r2=0,816) and plant growth regulators (r2=0,467). Mortality correlation data followed the same profile. CONCLUSIONS: This is one of the first studies of its kind to analyze global impact of pesticides exposure and cancer incidence and mortality. Results confirm that pesticides use must be considered as one of the major concerns for environmental and occupational health studies.

Abstract Number	**P-2-23-20**
Presenter	Alyson Lorenz*, Lindsay McCormick, Rebecca Dzubow, Brenda Foos
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	review

Pesticides in the Diets of Infants and Children: Twenty years of progress in assessing children’s dietary exposure to pesticides

Early lifestage exposure to certain pesticides has been associated with adverse health effects including neurobehavioral deficits and cancer. Protecting children from the effects of dietary pesticide exposure requires risk assessment methodologies that consider children's unique characteristics, such as less variety in diet and greater consumption of food per unit of body weight compared to adults. The U.S. National Academy of Sciences (NAS) called attention to these issues in publishing their landmark report Pesticides in the Diets of Infants and Children in 1993. Three years later, the U.S. Congress unanimously passed the Food Quality Protection Act (FQPA), requiring the Environmental Protection Agency (EPA) to implement several of the report's recommendations in its risk assessment processes, including using updated food consumption data based on children's dietary patterns, considering both cumulative and aggregate exposure, and incorporating an additional safety factor to better protect health during early lifestages. On the 20th anniversary of the report, we focus on the NAS recommendations which EPA is not legally mandated to incorporate in risk assessments, such as the use of probabilistic exposure distributions and data describing the impact of food preparation on residue levels. We discuss the extent to which EPA has implemented the recommendations that were not required by FQPA and the challenges faced in implementing the remaining recommendations. Finally, looking toward the future of risk assessment for children's dietary exposure to pesticides, we review recent recommendations from internal and external advisors and the peer-reviewed literature. We explore additional areas of focus, such as the use of epidemiological data in quantitative risk determinations and continued support of data collection on children's exposure to pesticides, and discuss remaining opportunities to improve the protection of children worldwide through dietary risk assessment.

Abstract Number	**P-2-23-21**
Presenter	Sabrina Llop, Jordi Julvez, Ana Fernandez-Somoano, Loreto Santa Marina, Esther Vizcaino, Carmen Iñiguez, Nerea Lertxundi, Mireia Gascón, Marisa Rebagliato, Ferran Ballester*
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cohort study

Prenatal and postnatal insecticide use and infant neuropsychological development in the INMA Spanish multicenter birth cohort study

Insecticides are frequently used in domestic settings, however there is limited evidence about exposure to currently used insecticides during vulnerable periods such as pregnancy and early life, as well as its possible adverse effects on child neuropsychological development. The aim of this study is to examine the association between residential insecticide use during pregnancy and infancy, and infant's neurodevelopment. Study subjects (n=1980) were participants in the INMA (Environment and Childhood) Project, a Spanish multicenter birth cohort study (2003-2008). Prenatal and postnatal use of indoor insecticides (yes, no) and other variables were obtained from personal interview during pregnancy and infancy. Method of application was also requested (sprays [no, yes] and plug-in devices [no, yes]). Mental and psychomotor development was assessed around 14 months using the Bayley Scales of Infant Development. The associations were analyzed by multivariate linear regression models. Fifty-four per cent of women used insecticides at home during pregnancy and 47% did it postnatally. Thirty-four per cent of women used insecticide sprays and 33% used plug-in devices during pregnancy. The percentage of women who used insecticide sprays postnatally lowered (22%), but the use of plug-in devices was similar to the prenatal period (32%). The use of insecticide sprays during pregnancy was associated with a decrement of the children's psychomotor development but postnatal use did not associate with mental and psychomotor development. The use of plug-in devices did not associate with neuropsychological development at any exposure period. The negative effect of the prenatal use of insecticide sprays was enhanced according to some modifying factors, as to be female, higher levels of prenatal exposure to PCB and mercury and a low social class. We found certain evidence about the adverse effect of using insecticide sprays during pregnancy on the psychomotor development of children. Some socio-demographic factors and other exposures could enhance that effect

Abstract Number	**P-2-23-22**
Presenter	Chloé Cartier*, Dave Saint-Amour, Charline Warembourg, Christine Monfort, Florence Rouget, Gaïd Le Maner-Idrissi, Gaël Durand, Sylvaine Cordier, Cécile Chevrier
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to organophosphate insecticides and Visual function in the mother-child PELAGIE cohort (France)

Background : Organophosphate pesticides (OP) were commonly used in agriculture and residential setting in the last decades. Whereas adverse developmental effects of OP on child motor and cognitive function have been suggested, their potential impact on sensory processing has not been assessed. Aims : To investigate the association between prenatal OP exposure and visual function in 6-year old children. Methods : From a random subcohort of the PELAGIE cohort that included 3500 pregnant women in Brittany (France, 2002-2006), 231 children were followed at 6-year old for neuropsychological assessment. Prenatal exposure was determined by assessing OP metabolites (Dialkylphophate DAP, Diethylphosphate DE and Dimethylphosphate DM) in maternal urine samples collected during the first trimester of pregnancy. Visual function was assessed using the Functional Acuity Contrast Test (FACT), which provides a fine measurement of near visual contrast sensitivity. Preliminary analyses based on multivariate regressions were conducted controlling for potential confounding factors including family stimulation from the Home Observation for Measurement of the Environment scale. Results : Mean DAP, DE and DM concentrations in nmol/L were 81.0 (n=211), 22.7 (n=115), 69.9 (n=207), respectively. DM urinary levels were significantly associated with a decrease in contrast sensitivity in boys at the lowest spatial frequency (β= -0.22 ; p=0.04 ; n=83). No significant association was found for girls. Conclusions : This study suggests that prenatal OP exposure may be associated with visual sensitivity deficits in childhood, especially for boys. The fact that alteration of contrast sensitivity was found only to the lowest spatial frequency suggests a deficit that is primary related to cortical processing instead of refractive error or ocular processing.

Abstract Number	**P-2-23-23**
Presenter	Irva Hertz-Picciotto*, Lora Delwiche, Hansen Robin
Exposure	others
Health domains	other
Type of research	others

Prenatal Exposures to Household Insecticides and Early Childhood Developmental Delay

Background: Prenatal organophosphate (OP) insecticide exposures have been linked to deficits in child cognitive development. Few human studies have examined pyrethrins (used for pet tick and flea control) or the primary replacement for household OP's, pyrethroids (in sprays and foggers for ants, flies, and cockroaches). Aims: To evaluate the association of home insecticide use during gestation with developmental delay (DD) at preschool ages. Methods: Two- to five-year olds who participated in the population-based case-control CHARGE (CHildhood Autism Risks from Genes and Environment) Study were assessed for cognitive and adaptive development, using, respectively, the Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales. Autism analyses are reported elsewhere. DD was defined as scoring <[mean-2*SD] on at least one instrument. Indoor home insecticide use was reported by mothers for three months preconception and pregnancy. Multiple logistic regression models predicting DD were adjusted for maternal country of birth and education, and child's age, sex, & California region of birth. Results: Adjusted for sociodemographics, the risk for DD was elevated with in-home professional or self-applications of insecticide sprays or foggers, e.g., 2nd trimester OR=2.6 (95% CI=1.4-4.8). In analyses weighted to adjust for under-participation by lower SES families, results were stronger: 2nd trimester OR=3.0 (95% CI=1.5-5.9). Receptive and expressive language scores were reduced in those exposed to sprays or foggers (p=0.02, 0.03, respectively). Excluding children with Down Syndrome did not impact results. Sensitivity analyses and imputations using product ingredient databases were most consistent with a role for pyrethroids rather than other insecticides. Conclusions: Although pyrethroid products are advertised as "natural," these results suggest a potential for early life developmental toxicity from prenatal exposures indoors, where residues may remain long-term.

Abstract Number	**P-2-23-24**
Presenter	Michael Welton*, Sara E Wagner, John Vena
Exposure	pesticides
Health domains	cancer
Type of research	cross-sectional study

Prostate Cancer Morbidity and Mortality and the Association of Agriculture Production in Georga Counties

Background: Prostate cancer is the most prevalent (138 cases/ 100,000) type of cancer in males in the United States and has the second highest mortality rate (22 deaths/100,000). In Georgia the prevalence rate is approximately 17% higher and the mortality rate is 10% higher than the nation. Existing literature has suggested that farming may be associated with prostate cancer through exposure to pesticides and limited health care access in rural areas. Alternatively, farming may protect against cancer because of active lifestyles and healthy diets. Georgia’s agriculture industry produces over $8 billion annually, leading the nation in production of many of its commodities. Aims: The goal of this study is to assess potential relationships between agricultural production and prostate cancer in Georgia Counties. Methods: This ecological study uses data from the Georgia Comprehensive Cancer Registry (1999-2008), 2000 US Census, and the United States Department of Agriculture to investigate associations between prostate cancer morbidity and mortality, and agriculture production in Georgia Counties (n=159). Multivariate regression models were used to determine associations between agriculture production and prostate cancer rates. Additionally, ArcGIS software was used to generate an interpolated surface of agriculture production in Georgia and spatially join this exposure to cancer incidence and mortality rates illustrating potential clusters. Results: This investigation reveals associations between agriculture production and prostate cancer morbidity and mortality (statistically significant at α=0.05) and illustrates geographic overlap between agriculture production and prostate cancer incidence. Conclusion: This preliminary investigation indicates that further research is necessary to determine the exact causes of the cancer morbidity and mortality disparities regarding agricultural practice and make recommendations for the future direction of research in this area.

Abstract Number	**P-2-23-25**
Presenter	Lesliam Quiros-Alcala*, Suril Mehta, Brenda Eskenazi
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cross-sectional study

Pyrethroid exposure and Neurodevelopment in U.S. Children.

Background: Pyrethroid insecticides are potential neurodevelopmental toxicants. Animal studies suggest that early life exposures to these insecticides are of concern; however, no human studies have assessed their effects on neurodevelopment in school-aged children. Aims: To examine the association between pyrethroid exposure and reported learning disability (LD), special education utilization/early intervention (SEd), attention deficit disorder (ADD), and joint report of LD and ADD in U.S. children participating in the National Health and Nutrition Examination Survey (NHANES). Methods: We analyzed data from NHANES 1999-2002, a period for which urinary metabolite measurements on 3-phenoxybenzoic acid (3-PBA; a non-specific pyrethroid metabolite) were available for children 6 to 15 years (n=1861). LD, SEd, and ADD diagnoses were determined from parental reports asking if a school and/or health professional had ever indicated that the child had any of these problems. Multivariate logistic regression was conducted to determine the association between urinary pyrethroid metabolite concentrations and outcomes. Results: The metabolite 3-PBA was detected in 77% of the children with a geometric mean level of 0.4ug/L. In multivariate analysis, 3-PBA concentrations were borderline significantly associated with parental report of SEd (second vs. first tertile, OR=1.8, 95%CI: 1.0, 3.2). We also observed that children in the second and third tertiles of 3-PBA exposure had a higher odds of having both LD and ADD compared to children with neither diagnosis (OR2nd tertile: 2.7, 95% CI: 1.2, 6.1; OR3rd tertile: 2.3, 95% CI: 1.0, 5.4). Conclusions: Findings suggest that exposure to pyrethroids in childhood is potentially linked to children having SEd, and/or LD and ADD combined. This is the first study to evaluate and observe a relation between pyrethroids and neurodevelopment in a large sample of the U.S. population. Acknowledgements: We would like to acknowledge the Passport Foundation for funding this work.

Abstract Number	**P-2-23-26**
Presenter	Rocio Castillo-Cruz*, Jorge Rodríguez-Reyes
Exposure	pesticides
Health domains	healthrelated quality of life
Type of research	exposure modeling

RISK ASSESSMENT AREAS FOR HUMAN HEALTH IDENTIFIED IN CROP SOIL AND THE RIVERS WATERS IN MORELOS, MEXICO.

RISK ASSESSMENT AREAS FOR HUMAN HEALTH IDENTIFIED IN CROP SOIL AND THE RIVERS WATERS IN MORELOS, MEXICO. Castillo-Cruz Rocio1, Rodríguez-Reyes Jorge 1. National Institute of Pediatrics, Laboratory for Experimental Immunology. Mexico City. E-mail: rocio.castillo@gmail.com BACKGROUND The production of p, p-DDT is banned in Mexico since 1991. AIMS Identify risk areas and evaluate in a period of three years, the presence and persistence in crop soils and rivers water of residues of organochlorine (OCPs) and organophosphurus (OPPs) pesticides in Tlaltizapan Morelos Mexico. METHODS Samples of soil and water was conducted within an area of 63 km2, .The soil sampling was performed by a stratified systematic square grid using the software Visual Sample Plan 5.0. Soil samples A (SA) and B.(SB) were taken in November 2008 and November 2009 at the end of the rainy season.Sample C (SC) in 2010 was after cutting cane in dry season. Water samples were in 2009 and 2010, of two rivers.The extractions of the compounds were quantified by gas chromatography coupled with a mass spectrum detector. RESULTS The frequency of detection of the reference 16 organchlorine compounds, in at least one of the sample, was: 87%, 93% and 100%, in SA, SB and SC, respectively.The compound p, p'-DDE was found in over 95% of sampling areas SA, SB and SC.Other compounds present were heptachlor γ-HCH, βHCH, p, p'-DDD and endrin aldehyde.Three sites which were identified in persistently the same compounds in soil.Not detected the presence of OPPs in water samples.Compounds HCH, heptachlor, endosulfan and p, p'-DDE were the most frequent residual OCPs in water, near planting sugarcane in the region and HCH from the public mains.Concentrations were less than or equal to those reported for water in the base of IRIS, as in the IARC. CONCLUSIONS The analysis of risk assessment can contribute evidence to identify danger zones, proposing models of prevention and monitoring agricultural populations exposed to pesticides. Support CONACyT 115032

Abstract Number	**P-2-23-27**
Presenter	Beatriz Gonzalez Alzaga*, Marina Lacasaña, Miguel Rodriguez Barranco, Clemente Aguilar-Garduño, Antonio F. Hernandez, Tesifon Parron
Exposure	pesticides
Health domains	neurodevelopment
Type of research	exposure measurement

Urinary levels of non-persistent pesticides (organophosphates, N-methylcarbamates, and pyrethroids) in children living in an agricultural community in Spain

Background: Limited information is available on biomonitoring of non-persistent pesticides in general population of Spain, mainly in susceptible populations such as children. Objective: To evaluate the exposure to non-persistent pesticides in children living in a community with intensive agriculture in South-East Spain. Methods: We conducted a longitudinal study in children 3-11 years old during the periods of low (LSP) and high (HSP) spread of pesticides (n= 160, n= 257, respectively). Children were selected from the schools by a simple random sampling. First morning urine samples were collected and kept at –40ºC until they were analyzed. Six dialkylphosphate (DAP) metabolites of organophosphate, four N- metabolites of N- methylcarbamate and five pyrethroids metabolites were analyzed by HPLC-MS/MS. Information on sociodemographic characteristics, pathological history, lifestyles, parental occupations, environmental exposures at home and diet was obtained by questionnaires applied to the mothers. Results: Forty one percent of urine samples in LSP and 71% of samples in HSP had measurable concentrations of at least one DAP metabolite. The geometric means of ∑DAP levels were 9.94 nmol/L and 20.56 nmol/L in LSP y HSP, respectively. 3-Phenoxybenzoic acid was observed in 12.5% of urine samples in HSP. The rest of metabolites was found in a low percentage (<3%) of samples in both periods. Conclusions: Levels of non-persistent pesticides in child urine were higher in HSP than LSP, although they were lower compared to those observed in similar studies carried out in Europe and America. Funding: Instituto de Salud Carlos III (Exp.: PI10/01101)

Abstract Number	**P-2-23-28**
Presenter	Lindsay McCormick*, Matthew Davis, Brenda Foos
Exposure	pesticides
Health domains	policy
Type of research	review

Utilization of the Food Quality Protection Act's Infant and Children Safety Factor and Implications for Dietary Pesticide Exposure in Children

Children are more vulnerable to the adverse health effects of pesticides because of their developing organ systems, immature metabolic functioning, less varied diet, and higher consumption of food per unit body weight than adults. In 1996, the US Congress enacted the Food Quality Protection Act (FQPA) to address children's unique vulnerabilities to pesticides. A major component of FQPA requires the US Environmental Protection Agency (EPA) to consider an additional 10-fold safety factor to protect infants and children when assessing the health risk of pesticides. To evaluate FQPA's success in protecting children from potential pesticide exposure, we first identified relevant pesticides based on their predicted exposure profile in children. Pesticides with both high residue levels and frequent overlapping use on produce that are consumed at proportionally higher rates by children than adults were selected, using data from EPA's 2011 Exposure Factors Handbook and the US's Pesticide Data Program. Results indicate that children (0-5 years) consume on average greater than seven times more apples, peaches, and pears by body weight than adults. Six pesticides used on these fruits were identified from the selection process, including the organophosphates phosmet and azinphos-methyl. Finally, we analyzed the evolution of EPA risk assessments for the identified pesticides, from those conducted prior to FQPA implementation to current assessments. Safety factor selection and its impact on allowed pesticide residues on apples, peaches, and pears were analyzed to assess the role of FQPA's 10x safety factor in protecting children against potential dietary exposure. Data gaps and uncertainties of studies cited in the risk assessments were considered to evaluate the context and validity of safety factor decisions. There is evidence that safety factor application has changed over time, potentially affecting FQPA's ability to address children's vulnerabilities to pesticide exposure.

Abstract Number	**P-2-24-01**
Presenter	Gwi Heum Eom*, Su Ryeon Noh, Yong Jin Jeon, Jung Ah Kim, Hyun Sook Bae, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	persistent organic pollutants
Health domains	other
Type of research	cohort study

A Follow-up Investigation of Some Hematological Parameters 4 years After Hebei Spirit Oil Spill.

Background: The liver function, lipids, and glycosylated hemoglobin levels increased as the clean-up activity was done for longer periods and/or the distance from the accident site became closer in baseline survey 1.5 years after the accident. We have performed two more follow-up surveys 3 years and 4 years after the accident. Aims: To study the effects of the Hebei Spirit oil spill on the liver function, lipid examinations and glycosylated hemoglobin level through the blood test of residents living in highly exposed area 4 years after the exposure. Methods: The two follow-up surveys were conducted in 2010 and 2012 after the baseline survey in 2009. We measured three liver function parameters including aspartate aminotransferase (AST), alanine aminotransferase (ALT), and γ-glutamyl trans peptidase (r-GTP), two lipid examinations including total cholesterol and high density lipoprotein cholesterol (HDL), and one glycosylated hemoglobin level including haemoglobin A1c (HbA1c). Results: Levels of some hematological parameters were not significantly elevated with the degree of exposure to the oil spill, such as the distance from the accident site to the residence and/or the clean-up activity duration any more after adjusting the covariates in both follow-up surveys 3 years and 4 years after the accident. However, the hematological parameters hardly decreased from the first survey to the second, and to the third survey. Conclusions: Several blood parameters hardly change during the two follow-up periods despite the passage of time. The further study is necessary to find whether the oil spill exposure cause long-term health effects.

Abstract Number	**P-2-24-02**
Presenter	Tamar Sofer, Elizabeth Schifano, Andrea A Baccarelli*, Lifang Hou
Exposure	organic compounds
Health domains	other
Type of research	others

A-clustering: A Novel Method for the Detection of Methylation Regions Associated with Exposure

Background: High-throughput methylation data have become increasingly abundant. There is a growing interest in powerful and efficient methods for detection of methylation regions associated with environmental exposure. Aims: Develop a method to identify regions of co-regulated methylation sites and detect their association with exposure. Methods: We develop the A-clustering algorithm that identifies sets of neighboring CpG sites that are co-regulated. We provide a software package that efficiently implements this algorithm, and performs a robust GEE-based analysis to study the association of the detected methylation regions with exposure. We examine the A-clustering and the testing approach in a correlation-preserving simulation study, and apply the method on 450K Infinium BeadChip data from peripheral blood of eighty pesticide applicators from a NIH-funded project studying genomewide DNA methylation patterns in response to pesticide exposure. Results: A-clustering and the proposed analysis pipeline are quick, robust, and perform well in simulations. Many regions of co-regulated methylation sites in the pesticides applicators data set did not correspond to known functional domains such as CpG islands. Similarly, 34% of the regions associated with exposure were not related to known functional domains. Conclusions: Regions of co-regulated CpG sites are broader than the pre-defined domains such as CpG islands and shores. The A-clustering is useful to detect such regions and their relation to environmental exposures. The proposed analysis pipeline is powerful and more efficient than other existing methods.

Abstract Number	**P-2-24-03**
Presenter	Ching-Chun Lin*, Pei-Hsuan Wu, Mei-Huei Chen, Wu-Shiun Hsieh, Pau-Chung Chen
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Association between phenolic compounds in umbilical cord blood and child growth

Background: Bisphenol A, nonylphenol, and octylphenol are lassified as endocrine-disrupting compounds (EDCs) which could lead the adverse effect on child growth. Aims: he objective of this study was to measure the phenols levels in cord blood and explore the effects of prenatal phenols exposure on birth size and child growth. Methods: A total of 401 pairs of parents and their infants were recruited which called Taiwan Birth Panel Study. We used the ultra-performance liquid chromatography – tandem mass spectrometry (UPLC/MS/MS) to measure the free form BPA, NP and OP in cord blood. Birth outcomes were obtained after delivery, and we followed up these children to obtain the growth data up to 24 months. The association between phenols levels in cord blood and child growth was assessed using linear regression and mixed models. Results:The median of BPA, NP, and OP concentration in cord blood were 1.5, 61.0, and 2.3 ng/mL, respectively. After adjusting the confounders, the head circumference decreased by 0.13 cm (95% CI: -0.23, -0.03) in association with a 1-unit increase in ln-NP concentration. Regarding the child growth, a 1-unit increase of ln-NP was significantly associated with a decrease in head circumference (β = -0.08, 95% CI: -0.16, -0.001 for 0-12 months), and height (β = -0.19, 95% CI: -0.38, -0.004 for 0-24 months). Conclusion: We observed an evidence of prenatal NP exposure may have an adverse effect on head circumference at birth and child growth in the early childhood.

Abstract Number	**P-2-24-04**
Presenter	Carmen Freire*, Rosalina Koifman, Paula Sarcinelli, Ana Cristina Rosa, Ruth Clapauch, Sergio Koifman
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cross-sectional study

ASSOCIATION BETWEEN SERUM LEVELS OF ORGANOCHLORINE PESTICIDES AND SEX HORMONES IN ADULTS LIVING IN A HEAVILY CONTAMINATED AREA IN BRAZIL

Background: Several studies have investigated the effects of organochlorine (OC) pesticides on adverse reproductive outcomes. However, few previous studies explored their effects on sex hormones. Aims: To examine the association between sex hormone levels and serum concentrations of OC pesticides in adults living in a rural area in Brazil heavily contaminated with these chemicals since the early 1960's. Methods: A cross-sectional study with 304 men and 300 women was undertaken. Wet weight serum concentrations of 19 OC pesticides were determined in all participants, while testosterone serum levels were obtained for men and estradiol, progesterone, prolactin, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were obtained for women. Associations between OC pesticides and sex hormones were evaluated using linear regression models. Results: Prevalence of women with non-physiological hyperprolactinemia was 4.0%. After adjusting for serum lipids and confounders, decreased testosterone levels in men were associated with concentrations of heptachlor (β=-0.03; 95%CI=-0.04;-0.009) and o,p'-DDT (-0.02, -0.05;-0.003). In postmenopausal women (N=77), LH was inversely associated with hexachlorobenzene (-0.13, -0.24;-0.02), p,p'-DDT (-0.01, -0.02;-0.003), p,p'-DDD (-0.09, -0.17;-0.02), endosulfan 1 (-0.24, -0.46;-0.03), endosulfan 2 (-0.14, -0.25;-0.03), aldrin (-0.01, -0.02;-0.003) and mirex (-0.07, -0.12;-0.02), as well as FSH was inversely associated with p,p'-DDD (-0.09, -0.15;-0.03) and endosulfan 1 (-0.23, -0.41;-0.05). Statistically significant associations between OC pesticides and sex hormones were not observed in premenopausal women. Conclusions: Inverse associations between OC pesticides and testosterone in men and LH and FSH in postmenopausal women, together with the high proportion of women with elevated prolactin levels, suggest that these OC compounds may have triggered anti-androgenic and estrogenic effects, respectively, in men and women in this population.

Abstract Number	**P-2-24-05**
Presenter	Weihui Liang*, Chao Wang, Jun Guan
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Characteristic of Volatile Organic Compound Concentrations Over Decoration Period and Long-term Decay after Completion of a New Residential Unit

High volatile organic compound (VOC) concentrations following building decoration have been observed frequently and they play a significant role in residents' health. To analysis VOC characteristic of decoration stage and after decoration, we measured the VOC of a new residential unit over the decoration period and after the completion of renovation in the real-life situation. The external windows and door were left closed for about 12hs before measurements. The Tenax TA tube was used to sample VOC at 0.2-0.5ml/min for 10-20min, then analyzed by gas chromatography/mass spectrometer (GC/MS) to identify VOC type and concentration. The total time scale was about one and a half years. The results indicated that there was an obvious concentration fluctuation during the decoration period, which total volatile organic compound (TVOC) concentrations fluctuated between 0.5-10mg/m3. By comparing the concentration after every decoration process complete, it indicated that door and doorframe, cupboard, furniture may the main VOC sources indoor. The indoor VOC concentration is rather high just after all the decoration process complete. A rapid decay of concentration level happened in the first few months and generally showed a slow decrease in the following months. Double-exponential model can be used to describe the long-term concentration decay pattern after decoration. Most of the VOC concentration decreased below Chinese national standard after decoration complete 6 months, but increased again in the following summer season. The concentration difference between each room is insignificant which means in the window close situation, if the time is longer than a certain hour, the house is well-mixed between each room.

Abstract Number	**P-2-24-06**
Presenter	Ida Henriette Caspersen, Helle K Knutsen, Anne Lise Brantsæter, Margaretha Haugen, Jan Alexander, Helle Margrete Meltzer, Helen Engelstad Kvalem*
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	cohort study

Dietary exposure to dioxins and PCBs in pregnant women: Results from the Norwegian Mother and Child Cohort study

Background: Dioxins and PCBs are persistent lipophilic substances that accumulate in the food chain, and diet is the most important source. The concentrations of dioxins and PCBs in blood are biomarkers of long term dietary exposure and body burden. The latter determines the exposure to the foetus, which is the most sensitive life stage for effects of dioxin and PCB. Aims: To 1) describe dietary exposure to dioxins and PCBs in a large group of pregnant women, 2) characterize important sources to dietary exposure, and 3) identify maternal characteristics related to high dietary exposure to dioxins and PCBs. Methods: Dietary exposure to dioxins (sum of TCDD equivalents (TEQ) from dioxin-like (dl) compounds) and PCB-153 in 83524 pregnant women (gestational weeks 17-22) who participated in the Norwegian Mother and Child Cohort Study (MoBa) during the years 2002-2009 was calculated based on a food frequency questionnaire (FFQ) and a database of dioxin and PCB concentrations in Norwegian food. Results: The calculated median intake of PCB-153 was 0.81 ng/kg bw/day. Intakes of PCB-153 (ln-transformed) showed two normal distributions, a larger one below (n= 81435) and a smaller one above (n=2089) the 97.5 percentile of the total range. The main difference between the two groups was that the women with higher exposure consumed seagull eggs and/or fish roe/liver pate. For dl-compounds, median intake was 0.56 pg TEQ/kg bw/day. Among the 2.4% exceeding the tolerable weekly intake TWI, roe liver pate and seagull eggs were the most important sources of exposure. Adjusted analysis showed that a higher dietary exposure was significantly associated with increasing maternal age, maternal education, weight gain during pregnancy, being a student, and alcohol consumption during pregnancy, while a lower exposure was related to increasing pre-pregnancy BMI and being a smoker. Conclusions: High dietary exposure to PCB-153 or total TEQ was mainly explained by consumption of seagull eggs and/or roe liver pate.

Abstract Number	**P-2-24-07**
Presenter	Aurélie Danjou*, Béatrice Fervers, Marie-Christine Boutron-Ruault, Françoise Clavel-Chapelon, Laure Dossus
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	cohort study

Dietary Exposure to Dioxins and Risk of Breast Cancer among Women from the French E3N Prospective Cohort

Background: Breast cancer incidence increased in France during the past thirty years, which cannot only be explained by population ageing or organised breast cancer screening. It has thus been hypothesized that some of the increase could be related to environmental exposure to endocrine disrupting chemicals such as dioxins. Dioxin emissions occur during combustion of chlorinated products (fires, municipal waste incinerators, production of herbicides, or metal industry). Seventeen dioxin congeners are toxic and one of them, tetrachlorodibenzo-p-dioxin, has been classified as a human carcinogen Group 1 by the International Agency for Research on Cancer. Dioxins can contaminate and accumulate in the food chain; therefore diet is considered the main source of exposure to dioxins in humans. Objective: We aimed to estimate the association between dietary exposure to dioxins and risk of incident breast cancer among women from the French E3N prospective cohort. Methods: The E3N prospective cohort involves nearly 100,000 French female volunteers, adherent to a single health insurance plan and followed since 1990, with the aim of identifying cancer risk factors. Our study focused on 68,995 women of the E3N study who responded to the self-administered food frequency questionnaire (FFQ) in 1993. We used dioxin contamination data in foodstuffs consumed in the general French population collected by the French High Council on Public Health in 1998. Dietary exposure to dioxins was calculated by multiplying concentrations of dioxins (pg TEQ/g fat content) in each food group with the amount reported in the FFQs. We used Cox proportional hazard models to estimate breast cancer risk associated with dietary exposure to dioxins, adjusting for known breast cancer risk factors. Results: Analyses are under way and results will be presented at the ISEE 2013 Annual Conference. Keywords: polychlorinated dibenzo-p-dioxins, polychlorinated dibenzo-furans, food frequency questionnaire, breast cancer, France, E3N

Abstract Number	**P-2-24-08**
Presenter	Eva Šovcíková*, Sona Wimmerova, Beata Drobna, Lubica Palkovicova, Tomáš Trnovec
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Environmental background in relation to cognitive and emotional development in children.

Background In bird cohort studies have been observed that low levels of polychlorinated biphenyls (PCBs) have a negative effects on early cognitive development in children. More recent studies support the hypothesis of negative effects of social background and family problems as strong confounders, which affect cognitive development strongly, as environmental PCBs. Aims To examine the association of cord blood and actual PCB exposures with neurodevelopment, at 6-years of age in a cohort of children residing in polluted area of Slovakia. Methods In each period the PCB congenerswere measured by HR-GC, and grouped as dioxin-like (DL-PCBs) and non-dioxin-like (NDL-PCBs). In children at 6-years of age (n=483) also the Wechsler Intelligence Scales were administered. Mothers were interviewed to introduce socio-demographic characteristics and home environment, and to complete the questionnaires (PSAI-Preschool emotional behavior of child, and CBCL-Check List of Preschool child behavior). Multiple linear regression was used to estimate associations between PCBs concentrations (of cord blood and at 6-years of age and scores on the Wechsler Scales and the scores on questionnaires and other evaluated psychosocial factors). Results The levels of NDL-PCBs in 4.quarter were associate with significantly lower scores in cognitive task-Blocks (spatial decision - cognitive function finishing maturation in postnatal age) as in 1.quarter of NDL-PCBs (higher performance in Blocks), p=0.002. Also PCB-153 6r_lip significantly correlated with Blocks-score (p=0.061). In multiple linear regression the lower neurodevelopment was significantly influenced by intelligence of mother, lower emotional background at home and ethnic, which were consider as confounders. Conclusions This study provides evidence of an association between NDL-PCBs and decreased performance on cognitive function and emotional disruptions of mother-child contacts in children with lower social background.

Abstract Number	**P-2-24-09**
Presenter	Hyang-Min Byun*, Larissa Takser, Maria Chiara Frisardi, Elena Colicino, Andrea A Baccarelli
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	exposure modeling

Epigenetic changes in frontal lobe of the brain with pre- and perinatal exposure to flame retardant BDE-47

Background: Environmental epidemiologists have shown increasing interest for alternative epigenetic markers, such as 5-hydroxymethylcytosine (5hmC) and methylation of mitochondrial DNA. Experimental models are needed to identify environmentally sensitive markers before their translation to epidemiology studies. Aims: We measured 5hmC and methylation of mitochondrial and nuclear genes related to behavioral and brain functions on rat brain from a toxicity study of PBDEs, bioaccumulative flame retardants that have been linked with neurodevelopmental effects. Methods: Wistar dams were exposed to BDE-47 (2 and 200µg/Kg body weight) from gestation day 9 and 16 to postnatal day 1, 8, and 15. Frontal lobes of offspring were used to measure: 1) global 5hmC and methylcytosine (5mC) by fluorometric quantification; 2) mitochondrial gene methylation, including COX1, COX2, and COX3, and 3) Nr3c1, Crhr1, Mc2r, Bdnf and Snca through bisulfite pyrosequencing. Results: Pre- and perinatal exposure to BDE-47 had significant effects on genomic and mitochondrial DNA methylation in rat brain. Global 5hmC methylation was significantly increased (p-value=0.024) with 200µg/Kg of BDE-47 exposure, while global L1Rn UTR methylation levels in frontal lobe decreased with 2µg/Kg of BDE-47 exposure (p-value=0.024). Mitochondrial COX1 and 2 genes showed a marginal decrease in methylation with 200µg/Kg of BDE-47 exposure (p-value=0.096 in overall CpGs from COX1 and p-value=0.009 in the 1st CpG from COX2) in frontal lobe. Mitochondrial COX3 showed a marginal decrease in methylation with 2µg/Kg of BDE-47 exposure in frontal lobe (p-value=0.09 in overall CpGs). A CpG site-specific decrease in methylation was observed in Bdnf and Nr3c1 from 2 and 200µg/Kg BDE-47 exposed rats, not in a dose dependent manner. Conclusions: Our data provide molecular evidence of epigenetic mechanisms of PBDE toxicity that may affect neurodevelopment and neuronal functions during vulnerable periods of brain differentiation.

Abstract Number	**P-2-24-10**
Presenter	Won-Jun Choi*, Soyoung Hong, Jung Hoon Kim, Wan Ryung Lim, Hojang Kwon, Hyung Jung Kim, Chaebong Kim, Hea Suk Yang
Exposure	organic compounds
Health domains	allergies
Type of research	cross-sectional study

Exposure to dibutyl phthalate (DBP) and eczema in children: A pilot study

Background: Recent studies suggest an association between the exposure to phthalate and atopic diseases in children. Aims: We aimed to evaluate whether the concentrations of urinary mono-n-butyl phthalates (MnBP), the metabolite of dibutyl phthalate (DBP), are associated with eczema in children. Methods: Urine samples were obtained from 152 children in three daycare facilities. The concentrations of urinary MnBP and creatinine were analyzed using high performance liquid chromatography (HPLC). The status of eczema in the past 12 months was evaluated using the questionnaire based on the International Study of Asthma and Allergies in Children core module. The questionnaire was completed by the parents or guardians of the subjects. The t-test and logistic regression analysis were performed. Results: The mean (standard deviation) age of subjects was 5.0 (1.0). The geometric mean of the concentrations of urinary MnBP was 163.4 µg /g creatinine (interquartile range 112.5-253.1 µg /g creatinine). Urinary concentration of MnBP in those who with eczema was significantly higher than those who without eczema (geometric mean 198.1, 152.4, respectively, p=0.02). Compared to subjects with low urinary MnBP (<10th percentile), subjects with high urinary MnBP (>90th percentile) were more likely to have eczema (odds ratio 15.5, 95% confidence interval 1.5-157.5; adjusted for age and gender). Conclusions: Exposure to DBP may be associated with the risk of eczema in children.

Abstract Number	**P-2-24-11**
Presenter	Wojciech Hanke*, Joanna Jurewicz
Exposure	others
Health domains	reproductive outcomes
Type of research	review

Exposure to phthalates: reproductive outcomes and children's health

Background: Phthalates are a family of industrial chemicals that have been used for a variety of purposes. As the potential consequences of human exposure to phthalates have raised concerns in the general population, they have been studied in susceptible subjects such as pregnant women, infants and children. This review aims at evaluating the impact of exposure to phthalates on reproductive outcomes and children health by reviewing most recent published literature. Methods: Epidemiological studies focusing on exposure to phthalates and pregnancy outcome, respiratory symptoms and neurodevelopment in children for the last ten years were identified by a search of the PubMed, Medline, Ebsco literature bases. Results: The results from the presented studies suggest that there are strong and rather consistent indications that phthalates increase the risk of allergy and asthma and have an adverse impact on children's neurodevelopment reflected by quality of alertness among girls, decreased (less masculine) composite score in boys and attention deficit hyperactivity disorder. Phthalates negatively impact also on gestational age and head circumference; however, the results of the studies were not consistent. Conclusions: Epidemiological studies, in spite of their limitations, suggest that phthalates may affect reproductive outcome and children health. Considering the suggested health effects, more epidemiologic data is urgently needed and, in the meantime, precautionary policies must be implemented.

Abstract Number	**P-2-24-12**
Presenter	Albino Barraza-Villarreal*, Maria Consuelo Escamilla-Nuñez, Leticia Hernandez-Cadena, Efrain Navarro-Olivos, José Luis Texcalac Sangrador, Claire Shackleton, Peter Sly, Usha Ramakrishnan, Isabelle Romieu
Exposure	organic compounds
Health domains	respiratory disease
Type of research	health impact assessment

Exposure to volatile organic compounds and nitrogen oxides and lung function in Mexican Preschoolers

Backgroud: Omega-3 fatty acid such docosahexaenoic acid (DHA) influence immune function and inflammation; however, the influence of prenatal DHA on infant respiratory function is unknown. Objective: To evaluate the impact of air pollutions on lung function in preschool children and evaluate the interaction between supplementation with omega-3 fatty acids and exposure to air pollution in this population. Methods. We realized forced oscillation lung function tests (respiratory resistance (Rrs6, 8 Hz) and reactance (Xrs6, 8 Hz)) using a Cosmed Quark i2m in 631 preschoolers whose mothers participated in a clinical trial of fatty acid supplementation omega-3 during pregnancy. For the exposure assessment to air pollutants we ran land-use regression models using local monitoring information at 60 sites in the state of Morelos. To evaluate the association we ran Gees Generalized Equation Models for binary data adjusting for important variables. Results. Respiratory function did not vary significantly between supplementation groups. An inverse relationship was observed between exposure to toluene and nitrogen oxides on lung function significantly (Rrs6, and Xrs6 8Hz, 8Hz ($p < 0.05$). We observed no significant interaction between treatment group and exposure to air pollutants. Conclusions. Exposure to air pollution affects lung function and growth lung of Mexican preschoolers. Key Words: Forced oscillation test, Preschoolers, lung function, omega-3 supplementation.

Abstract Number	**P-2-24-13**
Presenter	Soyoung Hong*, Won-Jun Choi, Wan Ryung Lim, Hojang Kwon, Hyung Jung Kim, Chaebong Kim, Jung Hoon Kim, Hea Suk Yang
Exposure	others
Health domains	allergies
Type of research	cross-sectional study

Frequent use of phthalates products is associated with allergic diseases in children

Background: Atopic diseases have been increasing over the years in Korea. It seems that environmental factors including hazardous chemicals in products which are used in everyday life may be associated with atopic diseases in children. Aims: This study aimed to investigate whether the exposures to phthalates products are associated with the symptoms of atopic diseases in children. Methods: A total of 35,590 children in Seoul, the capital of South Korea, participated in this cross-sectional study. The questionnaire was completed by the parents or guardians of the subjects. We asked the frequency of use of 18 phthalates products using questionnaire (no use: 0 point, less than 1 time per week: 1 point, average 1 time per week: 2 points, more than 1 time per week: 3 points, almost every day: 4 points). Sum of points (phthalate score) was considered as a surrogate of phthalate exposure in the household. To examine the symptoms of allergic diseases (asthma, allergic rhinitis, and eczema) in children, the questionnaire based on the International Study of Asthma and Allergies in Children core module was used. Complete data for analysis was available for 25,805 of 35,590 (72.5%) children. Results: The mean (SD) age of the subjects was 7.0 (3.0), range 0-12. The mean (SD) phthalate score 26.8 (8.8), range 0-68. The symptom prevalence of allergic diseases in the past 12 month was as followed: asthma 5.6%, allergic rhinitis 32.6%, and eczema 17.7%. Compared to subjects with low phthalate score (first quartile), subjects with high phthalate score (fourth quartile) were more likely to have symptoms of asthma, allergic rhinitis, and eczema (adjusted OR for asthma 1.22, 95% CI 1.04-1.43; adjusted OR for allergic rhinitis 1.37, 95% CI 1.27-1.48; adjusted OR for eczema 1.10, 95% CI 1.00-1.21). Conclusion: These findings suggest that frequent use of products containing phthalates may be associated with allergic diseases in children.

Abstract Number	**P-2-24-14**
Presenter	Courtney Carignan*, Wendy Heiger-Bernays, Michael McClean, Andreas Sjodin, Heather Stapleton, Thomas Webster
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Gymnast Exposure to Flame Retardants

Background. PentaBDE is a flame retardant used in polyurethane foam. It was phased out of production in the U.S. almost a decade ago due to evidence of bioaccumulation in humans and concerns regarding adverse developmental, reproductive, and neurotoxic effects. It can leach from products, and accumulate in the dust of indoor environments and in our bodies. Gymnastics training facilities typically contain large volumes of polyurethane foam in landing mats and loose foam pits. Aims. To determine if gymnasts have higher average concentrations of PentaBDE in their serum compared to the general U.S. population and measure levels in gym equipment, air, and dust. Methods. We recruited 11 female gymnasts from one gym in the U.S. Participants provided one sample of blood as well as before and after-practice handwipe samples. We screened gym equipment using XRF and collected samples of foam, air and dust. Environmental samples were analyzed using GC/ECNI-MS and serum was analyzed using GC/IDHR-MS. Results. The GM concentration of BDE-153 (32.5 ng/g lw) was four times higher in gymnast serum compared to the general U.S. population; GM concentrations of other pentaBDE congeners (BDEs 47, 99 and 100) were twice as high. Median concentrations of PentaBDE, 2,3,4,5-tetrabromo-ethylhexylbenzoate (TBB, EH-TBB) and bis(2-ethylhexyl) tetrabromophthalate (TBPH, BEH-TEBP) in paired hand-wipe samples were higher after-practice compared to before. We identified high levels of these flame retardants in pit cubes. Levels in air were five times higher near the pit vs. the other gym location. GM concentrations in gym dust were orders of magnitude higher than residences. Bromine was identified in all screened equipment with the highest levels in pit cubes and landing mats. Conclusions. Gymnasts in this sample experienced higher exposures to PentaBDE flame retardants than the general U.S. population. PentaBDE, TBB and TBPH identified in the gym environment likely contribute to gymnast exposure.

Abstract Number	**P-2-24-15**
Presenter	Zaitseva Nina*, Olga Ustinova, Alfiia Aminova, Olga Vozgoment, Marina Zemlyanova
Exposure	persistent organic pollutants
Health domains	diseases of the digestive system
Type of research	cohort study

HEPATOBILIARY DISORDERS IN CHILDREN CHRONICALLY EXPOSED TO PHENOL AND FORMALDEHYDE

Background. Adults with aerogenic exposure to formaldehyde (Fo) and phenol (Fen) demonstrate morphological and functional hepatobiliary disorders. In children, Fo and Fenimpact on the hepatobiliary system has not been studied well. Aims. To assess the characteristics of hepatobiliary disorders in children with chronic aerogenic Fen and Fo exposure. Methods. Astudy group (1) included 200 children aged 4-7 years with reactive hepatobiliary disorders and chronic aerogenic Fen and Fo exposure.A control group (2) consisted of 102 children who had no Fen and Fo exposure. Results.Group 1 resided in the area with high Fen and Fo concentrations in ambient air (average daily concentrations up to 0.011mg/m3 and 0.007mg/m3, respectively, the highest concentrations up to 0.024mg/m3 and 0.061mg/m3, respectively). Health HQ was 1.66 (Fen) and 2.82 (Fo),total HIfor both Fen and Fo for liver pathology development was 1.88, the contribution of Fen to the development of hepatobiliary pathologywas 88.3%. In group 1, blood samples containedhigh Fen (0.047±0.008 mg/dm3) and Fo (0.012±0.002 mg/m3) levels. In group 2, these values did not exceed the background levels. We detected changes in laboratory parameters – a 1.2-fold reduction in antioxidant activity (AOA) compared with group 2, a 1.2-fold increase inplasma malondialdehyde (P-MDA), hypoalbuminemia in 68% (group 1) and in 12% (group 2) (p=0.05), increased direct bilirubin (DB) (56% vs 28%, p=0.02 to 0.05), elevated total cholesterol (48% vs 18%, p=0.03), increased ALT (36% vs 7%, p=0.02) and AST(76% vs 21%, p=0.04). We determined cause-and-effect relationships between blood Fo levels and increasedDB (R2=0.34; p=0.049), ALT and AST (R2=0.34; p=0.042 and R2=0.513; p=0.024), between blood Fen levels and P-MDA (R2=0.2; p=0.041), AOA (R2=0.29; p=0.037). Conclusions. Hepatobiliary disorders associated with Fen and Fo exposure are accompanied by impaired redox homeostasis, lipid and pigment metabolism and by the cytolysis syndrome.

Abstract Number	**P-2-24-16**
Presenter	Manori Silva, Ella Samandar, James Preau, Jr, Antonia M. Calafat*
Exposure	organic compounds
Health domains	other
Type of research	exposure measurement

Human exposure to the plasticizer diisononyl-cyclohexane-1,2-dicarboxylate (DINCH) in the United States

Background: Since 2002, diisononyl-cyclohexane-1,2-dicarboxylate (DINCH) is being used as a plasticizer to replace phthalates such as di(2-ethylhexyl)phthalate (DEHP) and di-isononyl phthalate (DINP). Aims: To evaluate exposure to DINCH, DEHP and DINP by using the urinary concentrations of several of their metabolites. Methods: We determined the urinary concentrations of metabolites of DINCH, DEHP and DINP by on-line solid-phase extraction–isotope dilution-high performance liquid chromatography–tandem mass spectrometry in convenience samples of U.S. adults collected between 2000 and 2012. Results: We did not detect monocarboxyisooctyl-cyclohexane-1,2-dicarboxylate (MCOCH), mono(oxoisononyl)cyclohexane-1,2-dicarboxylate (MONCH), and mono(hydroxyisononyl) cyclohexane-1,2-dicarboxylate (MHNCH), three DINCH metabolites, in urine samples collected in 2000 and 2001. Only one of the samples collected in 2007 had measureable concentrations of DINCH metabolites. The detection rate for the three DINCH metabolites increased from 2007 to 2012. The urinary concentrations of MHNCH, MONCH and MCOCH were lower than those of the DEHP and DINP metabolites. We also observed an upward trend in urinary concentrations of the DINP metabolites, but a downward trend in the concentrations of the DEHP metabolites. Conclusions: Exposure to DINCH and to DINP might be increasing in the U.S. general population while exposure to DEHP appears to be decreasing likely as a result of changes in formulation of products, public awareness, and regulations of plasticizers. Because the use of alternatives to phthalate plasticizers might be on the rise, our findings also stress the importance of understanding exposure to these substitutes to evaluate their potential impact on health.

Abstract Number	**P-2-24-17**
Presenter	Erica Lee*, Katrina Kezios, Xinhua Liu, June-Soo Park, Darcy Tarrant, Yunzhu Wang, Myrto Petreas, Piera Cirillio, Barbara Cohn, Pam Factor-Litvak
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Levels of hydroxylated polychlorinated biphenyls (OH-PCBs) and thyroid function in pregnant women

Background Polychlorinated biphenyls (PCBs) are persistent contaminants. PCBs are metabolized into hydroxylated metabolites (OH-PCBs) now considered possibly more toxic than the parent compounds. Because PCBs may be associated with perturbed thyroid function, we examined the relationship between five OH-PCBs and thyroid function in pregnant women. Aims To examine the relationship between five OH-PCBs and 3 measures of thyroid function in pregnant women. Methods Stored postpartum sera from 442 pregnant women from the Child Health and Development Studies were analyzed for five OH-PCBs (4-OH-CB107, 3-OH-CB153, 4-OH-CB146, 3'-OH-CB138 and 4-OH-CB187) and stored second trimester sera were analyzed for free thyroxine (FT4), thyroid stimulating hormone (TSH) and thyroid peroxidase antibodies (TPOAb). Spearman correlations were used to examine the bivariate associations between each OH-PCB and each measure of thyroid function. Linear regression was used to examine the associations adjusting for potential confounders. Results Median concentrations of 3-OH-CB153, 4-OH-CB146, 3'-OH-CB138 were all 0.03 ng/ml. Median levels of 4-OH-PCB107 and 4-OH-CB187 were higher; at 0.08 ng/ml and 0.38 ng/ml, respectively. Mean (+ sd) concentrations of free T4, TSH, and ATPO were 1.26 (+0.21) ng/dl, 1.49 (+1.09) uIU/ml, and 28.9 (+76.6) IU/ml, respectively. Parent-compound and metabolites were correlated at 0.152-0.398. We found associations between 4-OH-CB107 and FT4 (estimated $\beta = 0.030$, $p = .029$), and between TSH and both 4-OH-CB187 (estimated $\beta = 0.099$, $p = .029$), and 3-OH-CB153 (estimated $\beta = 0.065$, $p = .033$). Conclusions Levels of OH-PCBs were consistent with reported literature. We found small associations between selected OH-PCBs and FT4 and TSH, suggesting that OH-PCBs are associated with changes in maternal thyroid status. Such changes may result in adverse outcomes in the developing fetus, and emphasize the need for research on long term outcomes associated with PCB exposure and thyroid dysfunction.

Abstract Number	**P-2-24-18**
Presenter	Michal Kicinski*, Mineke Viaene, Elly Den Hond, Greet Schoeters, Adrian Covaci, Alin Dirtu, Vera Nelen, Liesbeth Bruckers, Kim Croes, Nicolas Van Larebeke, Tim S. Nawrot
Exposure	organic compounds
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Neurobehavioral Function and low-level Exposure to Brominated Flame Retardants in Adolescents: a cross-sectional Study

Background Animal and in vitro studies demonstrated a neurotoxic potential of brominated flame retardants, a group of chemicals used in many household and commercial products to prevent fire. Aims To investigate the associations between biomarkers of internal exposure to brominated flame retardants [serum levels of polybrominated diphenyl ether (PBDE) congeners 47, 99, 100, 153, 209, hexabromocyclododecane (HBCD), and tetrabromobisphenol A (TBBPA)] and cognitive performance. Methods As a part of a biomonitoring program for environmental health surveillance in Flanders, Belgium, we assessed the neurobehavioral function with the Neurobehavioral Evaluation System (NES-3), and collected blood samples in a group of high school students. Cross-sectional data on 515 adolescents (13.6-17 years of age) was available for the analysis. Results A two-fold increase of the sum of serum PBDE's was associated with a decrease of the number of taps with the preferred-hand in the Finger Tapping test by 5.31 (95% CI: 0.56 to 10.05, p=0.029). The effects of the individual PBDE congeners on the motor speed were consistent. Serum levels above the level of quantification were associated with an average decrease of FT3 level by 0.18 pg/mL (95% CI: 0.03 to 0.34, p=0.020) for PBDE-99 and by 0.15 pg/mL (95% CI: 0.004 to 0.29, p=0.045) for PBDE-100, compared with concentrations below the level of quantification. PBDE-47 level above the level of quantification was associated with an average increase of TSH levels by 10.1% (95% CI: 0.8% to 20.2%, p=0.033), compared with concentrations below the level of quantification. We did not observe effects of PBDE's on neurobehavioral domains other than the motor function. HBCD and TBBPA did not show consistent associations with performance in the neurobehavioral tests. Conclusions Consistently with experimental animal data, PBDE exposure was associated with changes in the motor function and the serum levels of the thyroid hormones.

Abstract Number	**P-2-24-19**
Presenter	Matthew Lorber*, Krista Christensen
Exposure	organic compounds
Health domains	neurodevelopment
Type of research	exposure modeling

Part 1: Development of a Simple Pharmacokinetic Model to Predict BPA Concentrations in Urine

We constructed and calibrated a simple pharmacokinetic (PK) model to predict urinary concentrations of bisphenol A (BPA). This descriptive model has 3 compartments: a “stomach/liver” (SL) compartment, a “blood” (B) compartment, and a “bladder” (BL) compartment. Ingested BPA goes first to SL, then diffuses into B before being deposited into the BL. We calibrated and validated the model parameters using blood and urine measurements from 9 volunteers who consumed 5 mg of d16-BPA in a previously published controlled dosing study. This study was comprised of 2 parts: 1) 4 male volunteers provided blood samples 9 times from 0 - 381 min. We used these d16-BPA blood concentrations to fit our PK model and estimate model parameters; 2) 6 volunteers, 3 male and 3 female, provided blood collected 6 times from 0 - 24 hrs and urine (full voids) collected 8 times from 0 - 40 hrs. We used the urine and blood d16-BPA data in this second part to validate our model. Free d16-BPA could not be detected in either blood or urine samples; only d16-BPA glucuronide (d16-BPA-G) could be detected. The calibration was conducted, therefore, on d16-BPA-G on a molar basis, and the final calibrated parameters were assumed to apply simply to BPA. Calibrated parameters include the blood volume of distribution, and rates of movement from one reservoir to the next. Overall, the predicted values showed good agreement with the observed blood concentrations from the 4 volunteers, with a Pearson correlation coefficient of 0.80. For the second set of data, we found Pearson correlation coefficients for predicted and observed concentrations to be 0.87 (blood) and 0.97 (urine). We showed the importance of a “holding” reservoir, called for convenience in our model the SL compartment. Without it, a good agreement could not be found for data points later in the experiment; only by holding up metabolism by a deposition into this reservoir could these later data points be well simulated.

Abstract Number	**P-2-24-20**
Presenter	Maribel Casas*, Mark J Nieuwenhuijsen, David Martínez, Eva Govarts, Martine Vrijheid, Jens Peter Bonde
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

PCBs, p,p’-DDE and birth outcomes in 11 European birth cohorts: dose-response relationship and effect modifiers

Background: Low-level exposure to polychlorinated biphenyls (PCB) is inversely associated with fetal growth, but the dose-response relationship and effect modifiers of such association are not well established. This study is an extension of an earlier European meta-analysis. Aims: To explore the dose-response relationship between PCB-153 and p-p’-DDE and selected pregnancy outcomes, and to evaluate if no-effect threshold and susceptible subgroups exist. Methods: We used a pooled dataset of 8702 mother-child pairs enrolled in 14 study populations from 11 European birth cohorts. General additive models were used to evaluate the shape of the relationship between organochlorine compounds and pregnancy outcomes and analysis of interactions were performed. Results: We observed an inverse linear dose-response relationship between prenatal exposure to PCB-153 at levels below 1200 ng/L and birth weight (β=-200 g/µg PCB-153, 95%CI: -338, -62). No threshold or no-effect levels at very low PCB-153 concentrations were identified. The greatest reductions on birth weight were found in girls and in children born from smoking and non-Caucasian mothers. We also found a small but statistically significant alteration in gender ratio for PCB-153 (OR: 1.019; 95%CI: 1.001, 1.038) and p,p’-DDE exposure (OR: 0.992; 95%CI: 0.999, 0.996), corresponding to an increase and a decrease in the proportion of girls, respectively. Conclusions: This study suggests that the association between low-level exposure to PCB-153 and birth weight follows an inverse linear relationship. Our study also suggests that gender, maternal smoking, and ethnicity are effect modifiers of such association. Whether weak associations between PCB-153/p,p’-DDE and gender ratio reflects biological mechanisms remains to be established.

Abstract Number	**P-2-24-21**
Presenter	Lori Hoepner*, Robin Whyatt, Diurka Díaz, Antonia M. Calafat, Frederica Perera, Andrew Rundle
Exposure	organic compounds
Health domains	obesity
Type of research	cohort study

Prenatal Bisphenol A and Birth Weight in an Urban Minority Birth Cohort

Background: Prenatal exposure to the endocrine disruptor bisphenol A (BPA), a suspected obesogen, may have a role in the developmental origins of adult disease hypothesis. Objectives: We studied whether prenatal exposure to BPA was associated with birth weight and prenatal maternal weight in a New York City birth cohort. Methods: As part of the Columbia Center for Children's Environmental Health (CCCEH) birth cohort of African American and Dominican children living in the South Bronx and Upper Manhattan, 375 maternal third trimester prenatal spot urine samples were analyzed for BPA, of which 362 were also analyzed for phthalate metabolite concentrations. Mother's prenatal weight and weight gain during pregnancy were self-reported during the third trimester. Birthweight was collected from the hospital medical record for 369 cohort newborns with prenatal BPA concentrations. Results: Child sex, mother's weight gain, pre-pregnancy obesity, and parity were positively associated with birthweight (all $p<0.05$) while preterm status was negatively associated with birthweight ($p<0.001$). BPA was detected in 94% of samples collected prenatally from the mother. In linear regression analyses controlling for specific gravity, prenatal BPA concentrations were not associated with birthweight (beta=-42.73 g, $p=0.153$). After fully adjusting for the sum of prenatal urinary concentrations of di-ehtylhexyl phthalate metabolites and other predictors of birthweight, BPA was not associated with birthweight (beta=-13.72 g, $p=0.673$). In fully adjusted analyses stratified by sex, mother's weight gain, pre-pregnancy obesity, parity and preterm status there were no associations between birthweight and BPA. Neither pre-pregnancy obesity nor maternal weight gain during pregnancy were associated with prenatal BPA. Conclusion: In this cohort there is little evidence that prenatal BPA exposure is associated with birth weight.

Abstract Number	**P-2-24-22**
Presenter	Jin Hee Kim*, Young Ah Lee, Sanghyuk Bae, Seung Joon Chung, Choong Ho Shin, Yun Chul Hong
Exposure	organic compounds
Health domains	other
Type of research	cohort study

Prenatal exposure to phthalates affects bone age in 2 year-old infants

Backgrounds. Phthalates are widely used environmental chemicals with rising concerns on various health effects including abnormal growth and development. Previous studies suggestedantiandrogenic effectsby phthalates, particularly in infants. Aims. We evaluated the effect of prenatal exposure to phthalates on bone age in 2 year-old infants using birth cohort data. Methods. We launched a birth cohort study in August 2008 to estimate the relationship between environmental exposures and abnormal growth and development of neonates and young children and collected prenatal mother's urine on the day of visit for prenatal care. We selected 300 infants who were 2 year-old and diagnosed normally at their births from the birth cohort, and conducted health examination to follow up their health. We measured urinary levels of phthalates metabolites (MEHHP, MEOHP, and MnBP) to estimate prenatal exposure to phthalates (DEHP and DBP) and evaluated the relationship with bone age of the infants diagnosed using x-ray image. Results.After adjusted for age, sex, and BMI, both MEHHP and MEOHP were significantly associated with delayed bone age (MEHHP, estimate=-0.03, $p=0.034$; and MEOHP, estimate=-0.03, $p=0.046$). In particular, the effect of MEHHP and MEOHP on bone age was more apparent in males (MEHHP, estimate=-0.04, $p=0.035$; and MEOHP, estimate=-0.03, $p=0.061$) than in females (MEHHP, estimate=-0.01, $p=0.600$; and MEOHP, estimate=-0.01, $p=0.562$). The delayed effects of bone age by phthalates were not changed even after adjusting for weight at birth. Meanwhile, no effect of MnBP on bone age was found. Conclusions.Our results suggest that prenatal phthalate exposures affect bone age at 2 year-old.

Abstract Number	**P-2-24-23**
Presenter	Robin Whyatt*, Matthew Perzanowski, Allan C. Just, Andrew Rundle, Kathleen Donohue, Antonia M. Calafat, Lori Hoepner, Frederica Perera, Rachel Miller
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Prenatal phthalate exposures and childhood asthma among an inner-city birth cohort

Background: Phthalates are widely used chemicals in consumer products. Prior studies suggest that exposures to certain phthalates may affect child respiratory health, but no studies have evaluated effects of prenatal exposure on child asthma. Methods: We measured metabolites of four phthalates in spot urine samples collected during pregnancy from n= 327 African American and Dominican women in New York City. The phthalates were butylbenzyl phthalate (BBzP), di-n-butyl phthalate (DnBP), di-2-ethylhexyl phthalate (DEHP) and diethyl phthalate (DEP). Children with a history of wheeze or other respiratory symptoms on repeat questionnaires were seen by a pediatric allergist or pulmonologist between ages 5-12 years. Current asthma was diagnosed using standardized criteria. Children with no history of wheeze or other asthma-related symptoms were considered non-asthmatic. Results: A total of 173 children had a history of asthma-related symptoms; n=104 were diagnosed as current asthma and n=69 as without current asthma (for overall current asthma rate of 104/327, 31.8%). Compared to non-asthmatic children, relative risk (RR) for current asthma increased per loge BBzP metabolites in maternal prenatal urine: RR=1.13 (95% CI 1.03, 1.24). The dose-response relationship was significant. Compared to children with prenatal BBzP metabolite concentrations in the 1st tertile, the relative risk for current asthma among children in the 2nd tertile was 1.48 (95% CI 0.97, 2.26) and in 3rd tertile was 1.78 (95% CI 1.09, 2.91) (p=0.02 for the trend test). No significant associations were seen between metabolites of the other three phthalates and current asthma. Compared to non-asthmatic children, logeDnBP metabolite concentrations were associated with children who had a history of wheeze and other asthma-related symptoms but were diagnosed as without current asthma (RR 1.32 [95% CI 1.03, 1.69) but no dose-response was apparent (p=0.68 for trend test). Conclusion: Prenatal exposure to BBzP may increase the risk of current asthma during childhood.

Abstract Number	**P-2-24-24**
Presenter	Thomas Schettgen*, Monika Gube, Alt Anne, Andre Esser, Thomas Kraus
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	exposure measurement

Recent data on levels of hexachlorobenzene (HCB) and p,p'-dichlorodiphenylethylene (DDE) in plasma samples of the general population in Germany

Background: Within the Stockholm convention in 2001, persistent organic pollutants like hexachlorobenzene (HCB) and the insecticide dichlorodiphenyltrichloroethane (DDT) have been banned worldwide. Their high persistence led to an ubiquituous distribution and an age-dependent background burden in blood of the general population that is still detectable today, more than 30 years after the cessation of their use in Germany. Aims: More recent data on the plasma levels of HCB and the persistent metabolite of DDT (p,p'-dichlorodiphenyldichloroethylene, DDE) in the German general population have not been collected since the last German Environmental Survey (GerES) for adults in 1997-1999.Therefore, we have examined plasma samples of a large group of the general population on the concentrations of both HCB and DDE within current projects of our institute. Methods: Plasma samples of 2585 persons (1477 m, 1108 f) aged between 20 – 69 years living in Northrhine-Westfalia were collected between June 2010 and December 2012 and investigated for POPs using GC/MS. Results: HCB and DDE were quantifiable in 99.8 % and 99.9 % of all samples (LOQ 0.01 µg/L plasma). The 95th percentiles for HCB and DDE in plasma of different age groups were as follows: age 20 – 29 years (n=481) 0.16 and 1.13 µg/L plasma, respectively; age 30 – 39 years (n=589) 0.18 and 1.65 µg/L plasma; age 40-49 years (n=659) 0.28 and 2.63 µg/L plasma; age 50 – 59 years (n=654) 0.53 and 4.49 µg/L plasma and age 60 – 69 years (n=216) 0.93 and 7.78 µg/L plasma. Conclusions: Compared to the 95th-percentile of the data of the last GerES in 1997-1999, we observed a 90%-reduction in the background burden to HCB and a 70%-reduction in the background burden to DDE (as compared to Western Germany). Our present data may serve as a more recent basis for the evaluation of individual blood levels for both substances within biological monitoring.

Abstract Number	**P-2-24-25**
Presenter	Mee-ri Lee*, Jin Hee Kim, Yoon-Hyeong Choi, Sanghyuk Bae, Yun-Chul Hong
Exposure	organic compounds
Health domains	obesity
Type of research	others

Relationship between Bisphenol A exposure and obesity in the elderly

Background: Bisphenol A (BPA) is ubiquitous material which is well known as an endocrine disruptor. Obesity is a major risk factor for many chronic diseases. A few recent epidemiologic studies have focused on a relationship between BPA exposure and obesity. Most of them, however, were cross-sectional. Aims: We conducted a panel study with repeated measurement to evaluate relationship between BPA and obesity in elderly people. Methods: A total of 560 elderly participants ages 60 or over were recruited in Seoul from 2008 to 2009. Subjects visited a community elderly welfare center as many as five times for medical examination Urinary BPA levels and BMI were measured at every visit. We defined above 25 for body mass index (BMI, kg/m2) as obesity and estimated the relations between log-transformed continuous or quartile level of urinary BPA and BMI. GLIMMIX analysiswas performed after adjusted for age, sex, low-density lipoprotein cholesterol level, vitamin complex intake, alcohol consumption, regular exercise, total calories intake, and urinary cotinine concentrations. Results: The geometric mean of BPA was 0.6μg/g creatinine.There was a significant relationship between log-transformed BPA levels and obesity (Odds ratio [OR] 1.19; 95% Confidence interval [CI] 1.06-1.34). We found the second and fourth quartiles of urinary BPA levels had significantly elevated ORs compared with the first quartile (OR 1.51; 95% CI 1.05-2.19, and OR 1.61; 95% CI 1.09-2.39, respectively) Conclusions: Our result suggests that urinary concentrations of BPA are significantly associated with obesity in the elderly. Thus, controlling environmental BPA exposure may be important to reduce the risk of obesity.

Abstract Number	**P-2-24-26**
Presenter	Emiko Okada*, Ikuko Kashino, Seiko Sasaki, Chihiro Miyashita, Tamiko Ikeno, Atsuko Araki, Jun Yamamoto, Hideyuki Matsuura, Toru Matsumura, Akiko Tamakoshi, Reiko Kishi
Exposure	persistent organic pollutants
Health domains	allergies
Type of research	cohort study

Relationship between prenatal exposure to perfluorinated compounds and allergic diseases in infants

[Background]Recent studies have shown that prenatal exposure to perfluorinated compounds (PFCs) at general environmental levels has an adverse effect on infants. Immunotoxic effects of PFCs exposure in animal studies include immunosuppression, suppression of IgM antibody production, and increased IgE response in ovalbumin-sensitized mice. However, epidemiological studies investigating the role of PFCs, in particular longer-chain PFCs, are scarce. [Aims]The aim of this study was to investigate the relationship between prenatal exposure to 11 PFCs and infant allergic diseases during the first 12 months of life in a large study population. [Methods]The study population was comprised of mothers and their infants enrolled in a prospective birth cohort study (Hokkaido Study on Environment and Children's Health). Between February 2003 and December 2009, 300 women were randomly selected every year. Eleven PFC compounds were measured in maternal plasma using simultaneous analysis with UPLC-MS/MS. Characteristics of participants and information on infant allergic diseases was obtained from self-administered questionnaires and medical records. Finally, 2,062 mothers and their infants were included in the statistical analysis. [Results]Risk of eczema, wheezing and food allergy during the first 12 months of life was not associated with maternal levels of 11 PFCs, including longer-chain compounds. Odds ratios for eczema and wheezing ranged from 0.66 to 0.73 and from 0.60 to 0.81 for the three higher quartiles of maternal perfluorotridecanoic acid (PFTrDA) levels, compared with the lowest in the adjusted models, but no dose-response pattern was found. [Conclusions]These findings suggest that prenatal exposure to 11 PFCs, including longer-chain compounds, is not associated with risk of infant allergic diseases. Further studies are ongoing to investigate the effects of prenatal exposure to 11 PFCs on cord blood IgE levels, and allergies and infectious diseases at the age of 2 and 4 years.

Abstract Number	**P-2-24-27**
Presenter	Dieneke Schram-Bijkerk, Jelle Vlaanderen, Kaspar Schmid, John Cherrie, Dick Heederik, Laura MacCalman, Lützen Portengen, Alastair Robertson, Martie van Tongeren, Roel Vermeulen, Hanneke Kruize*
Exposure	organic compounds
Health domains	cancer
Type of research	occupational study

Risk of developing hematopoietic cancer associated with the use of the benzene-containing cleaning product 'PX-10' in the Dutch Armed Forces

Background: Liability claims were filed against the Dutch Ministry of Defence (MoD) related to serious health complaints due to the historical use of the weapon cleaning and maintaining product PX-10. PX-contained 0.1% benzene till 1970, but thereafter, concentrations fell sharply. Yearly average levels of exposure to benzene have been estimated to lie between 0 and 0.5 ppm in various exposure situations in the Dutch Armed Forces. Aim: To quantify the risk of developing acute myeloid leukaemia (AML) associated with the use of PX-10. Methods: Two realistic 'high-risk' career scenarios were included in life table analysis using multiplicative risk functions. One scenario represented military personnel of the Navy, who cleaned small arms in weapon rooms and on ships and the other represented civilians cleaning small arms in small workshops. Results:Three to four per 1,000 Dutch men develop AML during their lifetime in the general population. The additional risk of developing AML among military personnel who worked with PX-10 intensively for many years was determined to be 0.03 extra cases per 1,000 men. Conclusion: It seems unlikely that additional cases of AML will have developed among Dutch military personnel due to the use of PX-10, even if a few thousand military personnel were exposed to PX-10.

Abstract Number	**P-2-24-28**
Presenter	Yaoxing Wu*, Victor W.C. Chang
Exposure	organic compounds
Health domains	cancer
Type of research	exposure measurement

Source apportionment analysis of polyfluorinated alkyl substances in air-conditioned offices in Singapore

Volatile polyfluorinated alkyl substances (PFASs) including fluorotelomer alcohols (FTOHs) and fluorooctane sulfonamides/-ethanols (FOSAs/FOSEs), have become an increasing public health concern, since they are known to be degraded metabolically to the persistent and bioaccumulative ionic PFASs. The aim of this study is to investigate the indoor sources of volatile PFASs, which are apportioned into three broad categories – ventilation systems, occupant activities and indoor materials. The contribution of ventilation system is investigated through air sampling at the supply and return air ducts, while the influence of occupants' activities is studied via sampling during periods with and without occupants. The contribution of indoor materials is examined by sampling at four similar offices sharing one air-conditioning system. Analyte determination was based thermal desorption and GC–MS. Results indicated the concentrations of PFASs measured at the ducts of ventilation systems were at similar levels with those taken at center point of the office, implying the insignificant contribution from the HVAC system under the local context. In addition, no significant concentration differences were observed between air samples taken with and without human occupancy. This finding was further confirmed by the personal exposure measurement. This indicated the unlikely sources from the personal care products and other human activity related mechanisms for volatile PFASs in the office environment. The highest contributor of volatile PFASs was identified as the indoor materials. Significant variations in the chemical composition of the PFAS mixtures were also observed in offices with different types of products and furniture. The samples measured were also compared with those samples taken two years ago, and the result showed a considerable increase of 6:2 FTOH. All these findings suggest the commercial products used in local offices might be the major contributor to the indoor PFAS concentration and the sources are expected to dominate in the long term.

Abstract Number	**P-2-24-29**
Presenter	Sachiko Itoh*, Jumboku Kajiwara, Chihiro Miyashita, Sumitaka Kobayashi, Seiko Sasaki, Susumu Ban, Tamiko Ikeno, Atsuko Araki, Reiko Kishi
Exposure	organic compounds
Health domains	other
Type of research	cohort study

THE EFFECTS OF HYDROXYLATED PCBS IN MATERNAL SERUM ON INFANT THYROID HORMONES

Background and Aims: The usage of Polychlorinated biphenyls (PCBs) was banned in 2004 because of their persistent organic pollutants. However, PCBs and their metabolites have been detected in animals and environment, and no epidemiological report addressing the effects of hydroxylated PCBs (OH-PCBs), most well-known metabolites of PCBs, on human thyroid hormones among infants. The aim of this study was to examine the association of the concentrations of OH-PCBs in maternal serum with thyroid hormones, TSH and FT4 in their infant serum. Methods: 514 women who took prenatal health care at the Toho hospital (Sapporo, Hokkaido, Japan) participated in this study. We obtained the perinatal information from the questionnaire and medical records. OH-PCB concentrations (Total OH-PCBs, OH-PCB-107, 146+153, 172, 187) in maternal serum were measured after the second trimester of pregnancy or after delivery by Fukuoka Institute of Health and Environmental Sciences, and TSH and FT4 in maternal and infant serum were obtained from Sapporo City Institute of Public Health. The univariate and multiple linear regression analyses were performed to investigate the relationships between each OH-PCB level and thyroid hormones. Results: Among 514 women, mothers and their infants who had both data of OH-PCB levels and their thyroid hormones were analyzed (N=222). The concentration levels of OH-PCBs and PCBs in maternal serum were correlated statistically and OH-PCB levels in maternal serum were relatively low compared to previous reports. In the analyses of the correlations of OH-PCBs and thyroid hormones, there was significant association between maternal OH-PCB-146+153 and TSH of female infants in adjust model. No association was seen between Total, other OHPCBs thyroid hormones in infant serum. Conclusions: This study showed that there was significant association between maternal OH-PCBs and female TSH at low level exposure. These results also indicate the possibility that OH-PCBs may disrupt infants' thyroid hormone homeostasis .through placental transfer.

Abstract Number	**P-2-24-30**
Presenter	Nikola Nowack*, Jürgen Wittsiepe, Monika Kasper-Sonnenberg, Axel Schölmerich, Michael Wilhelm
Exposure	persistent organic pollutants
Health domains	neurodevelopment
Type of research	cohort study

Possible association of prenatal exposure to endocrine disruptors with sex-typical development and autism traits – Results from the Duisburg birth cohort study

Background: Polychlorinated biphenyls (PCB), dibenzo-p-dioxins and dibenzofurans (PCDD/F) are characterized as endocrine disruptors (ED) that assumedly influence steroid hormones. During pregnancy brain development depends on hormones, especially fetal testosterone (fT) which plays a crucial role for the male-typical brain differentiation. Studies have found relations between fT and empathy, analytical thinking and sex-typical play behaviour. The causes of autism spectrum conditions (ASC) are yet unclear, however some researchers see them as an extreme form of the male brain. ED might influence fT which in turn might influence sex-typical behaviour and autistic traits. Aims: Within the Duisburg birth cohort study we investigated the effects of prenatal exposure to PCB and PCDD/F on sex-typical behaviour and autism traits. Methods: WHO2005-TEqs of PCB and PCDD/F (pg/g lipid base) in maternal blood were used as a measure for exposure. At 8-10 years of age the mothers of 97 children (52 boys) filled out the "Empathy-Systemizing-Quotient" (EQ-SQ), assessing sex-typical cognition. At 9-11 years of age the mothers of 102 children (54 boys) completed the "Social Responsiveness Scale" (SRS), an autism rating scale. Results: Exposure to PCB and PCDD/F was within background levels (e.g. medianPCB = 6.85 ± 3.88). We found negative correlations between PCB levels and the EQ (r_s = -.320, $p < .05$) in girls and negative correlations between PCDD/F levels and the SQ (r_s = -.330, $p < .05$) in boys. The SRS was inversely related to PCDD/F levels (r_s = -.301) and PCB levels (r_s = -.265, all $p < .01$). When analyzed separately, correlations were no longer significant in boys but in girls. Conclusions: We found significant associations of prenatal background exposure to PCB and PCDD/F with sex-typical behaviour and autistic traits. The causes of ASC are still unknown, however it is assumed that they are multifactorial and environmental factors such as ED that alter fetal steroid hormone levels might be an important factor.

Abstract Number	**P-2-24-31**
Presenter	Paolo Mocarelli, Marcella Warner*, Amelia Wesselink, Jonathan Chevrier, Paolo Brambilla, Brenda Eskenazi
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

Maternal serum dioxin concentrations and neonatal thyroid function in Seveso children

Background: In animal studies, in utero exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), a known endocrine disruptor, has been associated with altered thyroid homeostasis and thyroid hormone concentrations.Limited epidemiologic evidence suggests in utero dioxin exposure alters neonatal thyroid function. Aim: On July 10, 1976, as a result of a chemical explosion, residents of Seveso, Italy experienced the highest levels of TCDD in a human population. In 1996, we initiated the Seveso Women's Health Study (SWHS), a retrospective cohort study of the health of the women. In 2008, we followed up the SWHS cohort to determine if maternal TCDD exposure is associated with neonatal thyroid function. Methods:Between the start of the Regione Lombardia neonatal thyroid registry (January 1, 1994) and December 31, 2009, 209 SWHS women reported 303 singleton live births. We abstracted neonatal TSH levels for 235 (~77%) births. We examined the relation of maternal serum TCDD levels (1976, 1996, at pregnancy) with neonatal TSH levels using generalized estimating equations and considered interaction by menarche status and age at explosion. Results: The geometric mean (±GSD) TSH level for neonates was 1.3 (±3.0) µU/ml, and ranged from 0.1 to 67.0 µU/ml; 13 neonates (5.5%) had TSH levels >5 µU/ml. There was a significant interaction with age at explosion ($p<0.05$). Among women who were <5 years in 1976, there was a significant positive association of neonatal TSH with 1996 TCDD (adj-β = 0.19; 95%CI 0.01, 0.37) and TCDD at pregnancy (adj-β=0.21; 95%CI 0.04, 0.39), but not with 1976 TCDD (adj-β=0.00; 95%CI -0.12, 0.13). Among women ≥5 years in 1976, neonatal TSH was not related to any measure of TCDD exposure. Conclusions: Our results confirm earlier epidemiologic findings that in utero dioxin exposure alters neonatal thyroid function and provides support for the hypothesis that TCDD exposure during developmentally vulnerable windows may increase susceptibility.

Abstract Number	**P-2-25-01**
Presenter	G. Lee Grenon, Scott A. Lear, Tim K. Takaro, Scott A. Venners*
Exposure	persistent organic pollutants
Health domains	diabetes
Type of research	cross-sectional study

Associations between plasma persistent organic pollutants and type II diabetes in Canadians: a nationally-representative, cross-sectional study.

Background: There is increasing evidence from epidemiological and toxicological studies that persistent organic pollutants (POPs) contribute to the pathogenesis of type II diabetes. Aims: To quantify the associations between plasma POPs and diabetes in cycle 1 (2007-2009) of the Canadian Health Measures Survey, a cross-sectional multistage sample representing 96% of Canadians. Methods: Our sample included 1669 participants aged 20 to 79. We used logistic regression with bootstrap resampling to analyze 19 POPs detectable in at least 60% of plasma samples. Diabetes was defined as any of self-reported doctor diagnosis, use of diabetic medication, fasting HbA1C >=6.5% or fasting glucose >=7.0 mmol/L. Results: The relative odds of diabetes (OR, 95% CI) for interquartile increases in log-transformed and lipid-normalized POPs after adjustment for BMI, waist-to-hip ratio (WHR), BMI-WHR interaction, daily leisure energy expenditure and age (sex was not a confounder) were 2.0 (1.2-3.3) for Arochlor 1260; 1.7 (1.1-2.9) for PCB 138; 2.1 (1.2-3.5) for PCB 153; 1.9 (1.0-3.4) for PCB 163; 1.9 (1.2-3.0) for PCB 170; 1.8 (1.2-2.8) for PCB 180; 1.7 (1.0-2.9) for PCB 187; 1.5 (1.1-2.1) for betahexachlorohexane; 1.4 (1.0-1.8) for hexachlorobenzene and 2.1 (1.0-4.6) for oxychlordane. Adjusted interquartile ORs with 2-sided p value >0.05 were 1.6 (0.9-2.7) for PCB 118; 1.6 (1.0-2.6) for PCB 146; 1.6 (0.9-2.7) for PCB 156; 1.3 (0.9-1.9) for PCB 194; 1.4 (0.9-2.1) for PCB 201; 1.3 (0.9-1.9) for PCB 203; 1.5 (0.9-2.3) for pp-DDE; 1.9 (0.7-4.8) for transnonachlor; and 1.1 (0.8-1.5) for PBDE 47. Conclusions: Most POPs were positively associated with the odds of diabetes in this sample although some estimates had insufficient precision. Our results add to the weight of evidence that POPs contribute to the pathogenesis of type II diabetes.

Abstract Number	**P-2-26-01**
Presenter	Benedetta Izzi, Juan J. Carmona*, Alexandra M. Binder, Allan C. Just, Jitendra Barupal, John Hutchinson, Oliver Hofmann, Joel D. Schwartz, Karin B. Michels, Andrea A Baccarelli
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Application of multiplexed reduced representation bisulfite sequencing (mRRBS) to environmental epigenetic studies: comparison to the 450K Illumina BeadChip

Background Multiplexed reduced representation bisulfite sequencing (mRRBS) is a gel-free, high-throughput approach for genome-wide, base-pair resolution DNA methylation analysis. mRRBS works with considerably lower amounts of DNA compared to the human 450K BeadChip Illumina microarray. Aims The aim of this analysis is to inform selection of the most appropriate technology to interrogate the methylome for environmental studies with respect to reproducibility and genomic coverage. Methods We have compared mRRBS with the 450K BeadChip using buffy coat genomic DNA extracted from 12 subjects selected from the Normative Aging Study cohort. We have evaluated concordance among duplicates, and how sample pooling and cluster density affect sequencing. Post-processing included read trimming with Trim Galore, alignment using Bismark, and merging of informative reads from both strands to estimate methylation levels. Data from the 450k BeadChip were normalized using a recent comprehensive pipeline. Results Of the 42 samples sequenced, 28 had more than 5M reads, >71% of which uniquely aligned to the genome, covering a median of 1.3M CpGs at ≥10x depth (300K to 2.5M CpGs). Sequencing at a higher cluster density yielded ~300K extra CpGs at ≥10x depth. Further evaluation of concordance was restricted to the sample from each individual with the greatest number of reads (>5M reads, n=11). Among this subset, there were 160K shared sites at ≥10x depth, with 1M found in 8 of 11. Between 24K and 124K sites per sample were represented on the Illumina 450K array. Pearson correlation coefficients between RRBS %methylation (≥10x depth) and quantile normalized 450K beta values for these 11 samples ranged from 0.92 to 0.95. Conclusions This novel, high-throughput technique offers one approach to interrogate variability in methylation level across the genome that is feasible for large environmental studies. Further investigation of sample quality, library construction, and measurement variability is ongoing.

Abstract Number	**P-2-26-02**
Presenter	Wei-Te Wu*, Chin-Ching Wu, Yu-Jen Lin, Ya-Hui Yang, Saou-Hsing Liou, Trong-Neng Wu
Exposure	gene-environment interactions
Health domains	cardiovascular disease
Type of research	cross-sectional study

Association between Vitamin D receptor (VDR) polymorphisms and matrix metalloproteinase-9 (MMP-9) in female workers of lead battery plants

Background Vitamin D receptor (VDR) genotype is a risk factor for several disorders with inflammatory components, including coronary heart diseases (CHD). Matrix metalloproteinases (MMPs), a group of zinc-dependent endopeptidases, involve extracellular matrix (ECM) physiological degradation process and contribute to progressive left ventricular remodeling, dilation, and heart failure. Aims To investigate whether the VDR genetic polymorphisms are associated with the activity of MMP-9 in female workers of lead battery plants. Methods A total of 206 female workers was recruited for this study at the Taiwan battery manufacturing plant. The mean age was 46.7 ± 8.5 years and mean working duration was 12.8 ± 8.1 years. A clinical examination was performed at a workplace health check-up, and information was obtained using self-reported questionnaire. Each study participant provided blood samples for genotyping of VDR (folk, bsml, apal) and for serum MMP-9, whole blood lead levels (BLLs) and serum oxidative stress (Malondialdehyde (MDA)) measurements. We used multiple linear regression models for determinants of MMP-9 using VDR genotypes, BLLs and MDA as independent variables Results The MMP-9 levels was found to be correlated with BLLs and menopausal status in female workers. In the trend analysis, results exhibited a significant decreased trend in MMP-9 levels from the wild-type, heterogeneity and homozygousgenotypes of VDR (apal and bsml). After adjusting for determinants of MMP-9 levels,we found that carriers of the AA genotype of VDR (apal) had a lower MMP-9 levelcompared with carriers of CC genotype in these subjects (β=-0.651, p=0. 012). A similar result was observed in carriers of the AG genotype of VDR (bsml) compared with carriers of CC genotype (β=-0.641, p= 0.008). Conclusions This study confirms that the BLLs and menopausal status are important determinants in the MMP-9 levels. There is a possibility that female workers who carry homozygous genotypes of VDR (apal and bsml) decrease in MMP-9 levels.

Abstract Number	**P-2-26-03**
Presenter	Marie-Abele Bind*, Brent A. Coull, Annette Peters, Andrea A Baccarelli, Letizia Tarantini, Pantel S. Vokonas, Petros Koutrakis, Joel D. Schwartz
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Beyond the mean: quantile regression to explore the air pollution effect on gene-specific DNA methylation in the Normative Aging Study

BACKGROUND: Air pollution has been related to mean changes in outcomes, including DNA methylation. Mean regression analyses may not capture associations that occur primarily in the tails of the outcome distribution, and can miss associations primarily in susceptible groups. OBJECTIVES: This study examines whether air pollution affects the DNA methylation distribution differently across quantiles. We focus on methylation on genes related to coagulation and inflammation: coagulation factor III (F3), intercellular adhesion molecule 1 (ICAM-1), toll-like receptor 2 (TRL-2), interferon gamma (IFN-γ), interleukin 6 (IL-6). METHODS: We measured gene-specific blood DNA methylation in 777 elderly men participating in the Normative Aging Study (1999-2009). We fit quantile regressions for longitudinal data to investigate whether the intermediate-term air pollution effect (4-weeks moving average) on DNA methylation (expressed in %5mC) varied across quantiles of the DNA methylation distribution. RESULTS: We observed significant effects of PM2.5, particle number, and ozone on the 10th to 50th percentiles of ICAM-1, IFN-γ, and IL-6 DNA methylation, while there was no significant air pollution effect on the 70th to 90th quantiles. An interquartile range increase in PM2.5 was associated with a 1.28%5mC (95%CI: [0.42; 2.14]) decrease on the 20th quantile of IFN-γ methylation, and was not significantly related to the 80th quantile (Estimate: 0.03%5mC, 95%CI: [-0.48; 0.54]). The effect of ultrafine particles captured by particle number was stronger on the 50th to 90th quantiles of F3 methylation, compared to the lower quantiles. CONCLUSIONS: We found that primary and secondary air pollutant effects were different across quantiles of the DNA methylation distribution, which would not have been detected by mean regression. These findings may suggest that ambient air pollution impacts systemic inflammation and links to disease exacerbation by low ICAM-1, IFN-γ, and IL-6 methylation, as well by high F3 methylation.

Abstract Number	**P-2-26-04**
Presenter	Michelle Plusquin*, Theo de Kok, Greet Schoeters, Vera Nelen, Willy Baeyens, Nicolas Van Larebeke, Tim S. Nawrot
Exposure	gene-environment interactions
Health domains	cancer
Type of research	cohort study

Blood gene expression of candidate genes in environmental carcinogenesis in association with particulate air pollution

Background: Exposure to ambient and occupational air particulate matter (PM) has been linked with increased risk of cancer. Aim: We study the association between eight genes selected as potential biomarkers of environmental carcinogenesis and particulate air pollution. Method: In 376 adults (age between 50.0 and 64.9 years) we studied the expression levels of eight key genes (cytochrome P450 1B1 (cyp1b1), activating transcription factor 4 (atf4), mitogen- activated protein kinase 14 (mapk14), super- oxide dismutase 2 (Mn) (sod2), chemokine (C-X-C motif) ligand 1 (melanoma growth stimulating activity, alpha) (cxcl1), diacyl- glycerol O-acyltransferase homolog 2 (mouse) (dgat2), tigger transposable element derived 3 (tigd3), PTEN-induced putative kinase-1 (pink1)) measured in peripheral blood cells by means of qPCR. We calculated PM10 exposure for different time windows (mean level at the day before blood sampling, week before and annual average) for each home address using a kriging interpolation method. Associations between PM10 and gene expression were established with regression models adjusted for sex, BMI, social class, smoking, age and apparent temperature. Results: Four (aft4, mapk14, tigd3, pink) of the transcripts were inversely associated with either the exposure to PM10 of the day of measurement and/or the exposure of the week before the measurement. On the long term, the annual mean PM10 exposure was positively associated (partial r= 0.1389 p= 0.0072) with the gene expression of dgat2 and negatively (partial r=-0.1691; p=0.0010) with the expression of tigd3. Conclusion: Both short and long-term exposure was associated with transcriptional changes in genes selected as potential biomarkers of environmental carcinogenesis.

Abstract Number	**P-2-26-05**
Presenter	Ki-Do Eum*, Sung Kyun Park, Linda Huiling Nie, Pantel S. Vokonas, David Sparrow, Howard Hu, Marc G Weisskopf
Exposure	gene-environment interactions
Health domains	cardiovascular disease
Type of research	cohort study

Cumulative Lead Exposure, HFE Polymorphism and QTc and QRSc intervals

Background: We previously reported an association between higher bone lead—a biomarker of cumulative lead exposure—and longer heart rate-corrected QT interval (QTc) among non-occupationally exposed elderly men. The hemochromatosis (HFE) gene product regulates the absorption of dietary iron. Polymorphisms in HFE cause iron overload and induce oxidative stress. Subjects with HFE variant genotypes may be more susceptible to lead exposure related health outcomes, such as electrocardiographic (ECG) conduction. Aim: We assessed whether two major functional single nucleotide polymorphisms (SNPs) of HFE, H63D (histidine-63-aspartate) and C282Y (cysteine-282-tyrosine), modify the association between bone lead and QTc, JTc, and QRSc intervals. Methods Among 649 men in the Normative Aging Study, bone lead concentrations were measured using K-shell X-Ray Fluorescence (KXRF) system. A standard 12-lead resting-state electrocardiogram was performed at the time of KXRF measurement and at a follow-up visit an average of 7.5 (SD=3.6) years later. We estimated the association between bone lead and ECG timing variables using repeated measures linear regression with main effects and the interactions between bone lead and both SNPs in the same model. Results H63D modified the association between tibia lead and QTc and QRSc intervals when H63D was coded as a count of variant alleles (0, 1, 2). However, this appeared driven by homozygotes (n=16). The association was significantly greater between tibia lead (per 13µg/g [interquartile range]) and QTc (an additional 36.4ms; 95% CI: 15.8-57.0) and QRSc (an additional 29.1ms; 95% CI: 12.0-46.2) among H63D homozygotes than among non-homozygotes. C282Y did not modify the tibia lead-ECG interval association. Results for patella Pb were much weaker. Conclusions These results suggest that the H63D polymorphism enhances the lengthening effect of low-level lead exposure on QTc and QRSc intervals.

Abstract Number	**P-2-26-06**
Presenter	Venerando Rapisarda, Massimo Bracci, Andrea Marconi, Lucrezia Fago, Lidia Proietti, Vera Cardile, Margherita Ferrante, Caterina Ledda*
Exposure	gene-environment interactions
Health domains	cancer
Type of research	exposure modeling

Cytotoxicity and genotoxicity effects induced by glass fiber in human alveolar cell line.

Background. Man-made vitrous fibers (MMVFs), have been widely used as a substitute for asbestos, as an insulation material. However the fibrous morphology of MMVFs raises concern about potential health hazard. In 1988, the International Agency for Research on Cancer (IARC) classified glass, rock, slag wools and ceramic fibers as agents that are possibly carcinogenic to humans Group 2B. Recently IARC (2002) reclassified glass, rock and slag wools and continuous glass filament as “not classifiable as to carcinogenicity to humans” Group 3, and confirms refractory ceramic fibers in the Group 2B. Aims. The aim of our study was to assess cytotoxic and genotoxic effects induced on a human alveolar cell line A549 by exposure to glass wool fibers (GW). Methods. Cells were exposed for 72 h to 5, 50, 100 microg/ml of glass wool, after incubation the cell viability was determined by a tetrazolium salt reduction (MTT) assay. The genotoxic effect was studies by Comet test. An undamaged cell appeared as a nucleoid and a cell with damaged DNA as a comet. Measurement of Comet parameters: % DNA in the tail, tail length and tail moment (the product of relative tail intensity and lenght, that provides a parameter of DNA damage) were obtained from the analysis. Results. A MTT assay indicated that glass wool caused a significant decrease in cell viability and this decrease was concentration-dependent. The results of the Comet test for DNA damage detection indicated in cell exposed to glass wool fibers a significant increase of mean TM value also concentration-dependent. Conclusion. All these results, even those obtained with the more low fibers concentration, provide that the glass wool fibers can induce cytotoxicity and genotoxicity on a human alveolar cell line.These results, combined with those obteined by humans recent epidemiological studies, indicate the need to re-evaluate the IARC classification on glass wool fibers.

Abstract Number	**P-2-26-07**
Presenter	Mary Carmen Baltazar-Reyes*, Horacio Riojas Rodríguez, Ostrosky-Shejet Patricia, Sordo Monserrat
Exposure	gene-environment interactions
Health domains	other
Type of research	cohort study

Early DNA damage in pregnant women and their unborn babies that live near to medical solid hazardous waste incinerators, Mexico.

Introduction: The “Quetzalcoatl” complex is located in central Mexico in the Huejotzingo municipality, Puebla, with 16 different industries including a medical solid hazardous waste Incinerator (MSHWI) has been functioning for 15 years. Residents and authorities of Huejotzingo, and the Government of Puebla have expressed their concern about the potential exposure to toxic substances and their possible health effects. Objective: To evaluate dioxins and furans blood serum levels and their association with early DNA damage in pregnant women and their babies. Methods: A longitudinal study on 320 pregnant women from Huejotzingo was performed. Three samples of the participants were obtained; one sample was the biomarker of early DNA damage (comet assay). A second sample was obtained to determine dioxin and furan concentrations and a third sample was collected to make micronucleus assay (MN). During the childbirth, a blood sample was obtained from umbilical cord to make comet assay and MN (subsample n=80). A questioner of maternal diet was made to the participants. Results: The average of DNA migration was 24.41µm (range 0-75µm). In the subsample, the MN median of the participants was 5.8 (range 0-22). In umbilical cord sample the DNA migration was 27.7µm, (range 12.5-85) and the MN average was 3.8 (range 0-14). We found a correlation between 12378-Hp-furan concentration and the comet assay (p=0.006). In the regression model it was found that when the concentration of 12378 furan increased and consume of orange or mandarin decreased, the participants exposed had more early DNA damage. In another regression model it was established that when the level of 2378 furan in blood is less there was minor early DNA damage in umbilical cord samples (p=0.01). Conclusion: There is genotoxic damage in pregnant women and their unborn babies by exposure to 2378 and 12378 furans.

Abstract Number	**P-2-26-08**
Presenter	Min A Jhun*, Howard Hu, Joel D. Schwartz, Marc G Weisskopf, Linda Huiling Nie, David Sparrow, Pantel S. Vokonas, Sung Kyun Park
Exposure	gene-environment interactions
Health domains	cardiovascular disease
Type of research	cohort study

Effect modification by Vitamin D receptor genetic polymorphisms in the association between lead and pulse pressure

Lead may increase the risk of cardiovascular disease by increasing blood pressure and worsening arterial stiffness through calcium metabolism. Vitamin D receptor (VDR) plays an important role in lead metabolism. However, the role of VDR genetic polymorphisms in the association between lead and pulse pressure has not been studied yet. We investigated effect modification by the VDR gene in the association between cumulative lead exposure and pulse pressure, a marker of arterial stiffness. We examined 727 participants in the Normative Aging Study. Tibia and patella bone lead levels were measured using K-x-ray fluorescence. Four single nucleotide polymorphisms (SNP) in VDR gene, Bsm1 (rs1544410), Taq1 (rs731236), Asp1 (rs7975232), Fok1 (rs1073581), were genotyped. To account for the repeated measurements, linear mixed effects models were implemented. The effects of lead, SNP, and lead by SNP interaction were investigated adjusting for age at baseline, time since baseline, body mass index, smoking, alcohol intake, diabetes status, family history of hypertension, and education. Age by SNP interaction was also included in the model considering different effect of genetic polymorphism by age. The participants with at least a copy of the minor allele in Bsm1 (n=442) had a stronger association between bone lead and pulse pressure than those with major alleles (n=238) (β for the interaction term=0.18mmHg (95% CI:0.04-0.32,p=0.01) for tibia lead; β=0.10 (95% CI:0.01-0.19,p=0.04) for patella lead). The participants with at least a copy of the minor allele in Taq1 (n=481) also had a stronger association between bone lead and pulse pressure compared to the others (n=242) (β=0.14 (95% CI:-0.001-0.27,p=0.05) for tibia lead; β=0.10 (95% CI:0.01-0.19,p=0.02) for patella lead). There was no significant effect modification by Fok1 or Asp1. The effects of genetic mutations on pulse pressure differed by age. This study suggests that subjects with the minor allele of Bsm1 or Taq1 are more susceptible to cumulative lead exposure-related elevated pulse pressure.

Abstract Number	**P-2-26-09**
Presenter	Akiko Eto*, Fumihiro Sata, Yasuhiro Kanatani, Atsuko Araki, Takahiko Mitsui, Reiko Kishi, Katsuya Nonomura
Exposure	gene-environment interactions
Health domains	reproductive outcomes
Type of research	cohort study

Fetal genetic polymorphisms associated with estrogen levels and sex-hormone-binding globulin and anthropometric parameters in newborns

Background: Consistent positive correlations between pregnancy estrogens and fetal size have been demonstrated; and a decrease in serum estradiol levels has been found in women with fetal growth restriction. Aims: We aimed to investigate whether fetal genetic polymorphisms associated with estradiol levels and sex-hormone-binding globulin (SHBG) affected anthropometric parameters in newborns. Methods: We conducted a prospective cohort study of 228 mother-newborn pairs delivered singleton live births in Sapporo, Japan. Twenty-nine single nucleotide polymorphisms (SNPs), which were reported to be associated with circulating estradiol and SHBG in recent genome-wide association studies (GWAS), were detected in Japanese newborns. Multiple regression models were used to evaluate the associations between fetal genotypes and birth weight, length, body mass index (BMI), ponderal index (PI), head circumference and chest circumference with adjustments for maternal age, parity, smoking status and alcohol use during pregnancy, and infant gender. Results: In the dominant model (for example, AA + AT vs. TT for rs402675), the estimated reductions in BMI were 0.7 kg/m2 (standard error [SE], 0.3 kg/m2) for rs402675 (3p26.3 between CNTN6 and RPL23AP38), 0.6 kg/m2 (SE, 0.2 kg/m2) for rs10454142 (2p16.3 between FOXN2 and PPP1R21), and 0.5 kg/m2 (SE, 0.2 kg/m2) for rs72829446 (17p13.1 near SHBG), respectively. The estimated reductions in PI were 0.18 kg/m3 (SE, 0.09 kg/m3) for rs402675, 0.18 kg/m2 (SE, 0.06 kg/m3) for rs10454142, and 0.15 kg/m3 (SE, 0.05 kg/m3) for rs72829446, respectively. Moreover, the estimated reductions in chest circumference were 0.7 cm (SE, 0.3 cm) for rs402675 and 0.8 cm (SE, 0.2 cm) for rs293428 (4q13.2 near UGT2B15) . Conclusions: Our findings suggest that some fetal genetic polymorphisms associated with estrogen levels and SHBG may be associated with anthropometric parameters in newborns in a Japanese population.

Abstract Number	**P-2-26-10**
Presenter	Fumihiro Sata*, Akiko Eto, Yasuhiro Kanatani, Atsuko Araki, Takahiko Mitsui, Reiko Kishi, Katsuya Nonomura
Exposure	gene-environment interactions
Health domains	reproductive outcomes
Type of research	cohort study

Fetal genetic polymorphisms associated with estrogen levels and sex-hormone-binding globulin and fetal growth restriction

Background: Intrauterine fetal growth restriction is a multifactorial disorder, and its etiology includes both environmental and genetic components. Consistent positive correlations between pregnancy estrogens and fetal size have been demonstrated; and a decrease in serum estradiol levels has been found in women with fetal growth restriction. Aims: We aimed to investigate whether fetal genetic polymorphisms associated with estradiol levels and sex-hormone-binding globulin (SHBG) affected fetal growth and pregnancy duration. Methods: We conducted a prospective cohort study of 228 mother-newborn pairs delivered singleton live births in Sapporo, Japan. Twenty-nine single nucleotide polymorphisms (SNPs), which were reported to be associated with circulating estradiol and SHBG in recent genome-wide association studies (GWAS), were detected in Japanese newborns. Multiple logistic regression and linear regression models were used to evaluate the associations between fetal genotypes and intrauterine fetal growth restriction (IUGR, defined as birth weight <10th percentile) and birth weight with adjustments for maternal age, parity, smoking status and alcohol use during pregnancy and infant gender. Results: The odds ratio (OR) for the risk of IUGR, in fetal AA and AT genotype groups in rs402675 (3p26.3 between CNTN6 and RPL23AP38) were 193.1 (95% confidence interval [CI], 5.0–7,354.8) and 13.9 (95% CI, 2.9–66.3) compared to the TT genotype group, respectively. The estimated reductions in birth weight were 673 g (standard error [SE], 221 g) and 132 g (SE, 66 g) for the AA and AT genotype groups, respectively. Conclusions: Our findings suggest that rs402675 in 3p26.3 region may be a susceptible marker to IUGR in a Japanese population.

Abstract Number	**P-2-26-11**
Presenter	Michael Scheurer*, Philip Lupo, Michele Follen
Exposure	gene-environment interactions
Health domains	cancer
Type of research	cross-sectional study

Gene-Environment Interactions and the Risk of Cervical Dysplasia: The Role of DNA Repair Genes and Diesel Particulate Matter

Background: There is growing evidence that air pollution, including diesel particulate matter (DPM), is associated with cervical cancer and dysplasia. One potential mechanism for DPM-induced mutagenesis is related to DNA damage. Therefore, we hypothesized that genetic variation in the DNA repair pathway may modify cervical dysplasia risk. Aim: Determine the role of DNA repair gene-DPM interactions on the risk of cervical dysplasia. Methods: Our study population was drawn from women participating in a multi-center Phase II clinical trial between 2000 and 2004, of which 129 had cervical dysplasia (cases) and 177 did not (controls). Census tract-level estimates of DPM concentrations were obtained from the United States Environmental Protection Agency 1999 National-Scale Air Toxics Assessment. Exposure was based on residence at clinic visit and was categorized as low (<75th percentile) or high (≥75th percentile). Genotyping on 768 single nucleotide polymorphisms (SNPs) in 13 DNA repair genes was performed using the Illumina Golden Gate platform. We utilized a 2-step approach to evaluate gene-environment interactions. In step 1, we examined the association between each SNP (G) and DPM exposure (E). SNPs where p<0.02 were then included in step 2, a case-control analysis of GxE interactions using logistic regression models. Results: In step 1 of our analysis, we identified seven SNPs that were associated with exposure. In step 2 of our analysis, there was one statistically significant interaction between NBN rs2735388 and DPM exposure (p=0.03). Specifically, women who were NBN rs2735388 AA and had high DPM exposure were more likely to have cervical dysplasia (odds ratio=2.90, 95% confidence interval: 1.17-7.20) compared to women who were TT/TA and had low DPM exposure. Conclusions: In one of the first assessments of gene-air pollution interactions and cervical dysplasia, we found that DPM-associated disease risk was modified by genetic variation in the DNA repair pathway.

Abstract Number	**P-2-26-12**
Presenter	Anezka Necasova, Pavel Cupr*
Exposure	gene-environment interactions
Health domains	other
Type of research	exposure measurement

Genotoxicity evaluation of UV sunscreen Ethylhexyl methoxycinnamate and its photoproducts

Background and Aims: Sunscreens are substances used in cosmetic products protect against harmful UV radiation as UV-filters against penetration of UVA and UVB rays. Ethylhexyl methoxycinnamate (EHMC, CAS: 5466-77-3), UV-B filter, is one of the most used sunscreen in the world. Under normal conditions it occurs in a mixture of two isomers trans-EHMC and cis-EHMC in a ratio of 99 % : 1 %. When the substance is exposed to sunlight (containing UV radiation) it occurs to photo-transformation of the trans-isomer to the cis-isomer, which is less stable and the efficiency of UV-filter is reduced.We focus on genotoxicity testing of this emerging photoproduct, which has different characteristics. It is important to highlight this issue in order to verify the safety of substances placed emphasis on products generated during exposure. Methods: We used UV-lamp (400 W) to irradiate the EHMC and obtain the photoproduct cis-EHMC. We determined the concentrations of the trans-EHMC and photoproduct cis-EHMC in the mixture using HPLC analysis. Genotoxic potential was then evaluated by SOS-chromotest on the bacterial strain Escherichia coli K-12 PQ37 and by UMU-C test on the bacterial strain Salmonella typhimurium TA1535/pSK1002. Results and Conclusions: The significance of individual genotoxic effect was evaluated. Direct response in different genotoxicity tests on both versions of sunscreen: irradiated and un-irradiated EHMC was compared. We thus simulated the real exposure to that substance, with an accent on all aspects, impacts or reactions, which could influence the course of exposure.

Abstract Number	**P-2-26-13**
Presenter	Ki-Do Eum*, Ryan Seals, Matthew Grespin, David Umbach, Dale Sandler, Howard Hu, Freya Kamel, Marc G Weisskopf
Exposure	gene-environment interactions
Health domains	neurodegeneration
Type of research	case-control study

Interaction Between HFE Polymorphisms and Cumulative Lead Exposure on the Risk of Amyotrophic Lateral Sclerosis

Background We previously found an association between cumulative lead (Pb) exposure and risk of amyotrophic lateral sclerosis (ALS). Polymorphisms in the hemochromatosis (HFE) gene—involved in regulating iron uptake—have previously been associated with ALS. Oxidative stress may contribute to ALS pathophysiology, and excess iron can amplify toxic effects of Pb related to oxidative stress. No study has examined the possible modifying role of HFE on the association of cumulative Pb exposure with ALS risk. Aim To determine whetherHFEpolymorphisms alter the association of cumulative Pb exposure with ALS risk. Methods We measured bone Pb—a biomarker of cumulative Pb exposure—using K-shell-X-Ray Fluorescence in 100 neurologist-confirmed ALS cases and 192 controls from New England. We genotyped H63D and C282YHFE polymorphisms; participants were considered variant carriers or not for each. We estimated odds ratios (ORs) and 95% confidence intervals (CIs) for ALS using logistic regression adjusted for age, sex, education, and smoking. To assess effect modification by HFE polymorphism, we included in one model terms for Pb (continuous), H63D and C282Y genotypes (separately), and separate cross-product terms between Pb and the polymorphisms. Results We found an elevated OR for ALS among H63D variant carriers (OR: 5.30; 95% CI: 1.81-15.52), but not C282Y carriers, as seen in other studies. The cross-products terms indicated that the OR for association of patella lead with ALS among C282Y variant carriers was 15 times larger (15.48; 95% CI: 1.54-155.9) than that among those without C282Y variants, while the OR among H63D variant carriers was about half as large (0.43; 95% CI: 0.20-0.93) as that among those without H63D variants. Conclusion Our results suggest that the H63D and C282Y HFE genotypes modify the association of Pb with ALS risk, but in opposite directions. Thus effects on iron are unlikely to explain the findings since both H63D and C282Y increase labile iron.

Abstract Number	**P-2-26-14**
Presenter	Nelly Saenen*, Esmée Bijnens, Michelle Plusquin, Bram Janssen, Wilfried Gyselaers, Patrick De Boever, Tim S. Nawrot
Exposure	gene-environment interactions
Health domains	other
Type of research	cohort study

Placental brain-derived neurotrophic factor is at the transcript level associated with maternal exposure to air pollution

Background Recent studies suggest that neurotrophins such as brain-derived neurotrophic factor (BDNF) potentiate placental development and play an important role in fetal growth. The regulation of fetal growth has an important influence for the individual's susceptibility to diseases later in life. Also studies have provided evidence that maternal exposure to air pollution may affect different pregnancy outcomes such as fetal growth and birth weight. Aims Here we investigate the effect of maternal exposure to air pollution on the neurotrophin signaling pathway of BDNF. Methods 40 Mother-infant pairs were randomly selected from the ongoing ENVIRONAGE birth cohort without active or passive tobacco smoke exposure. Placental biopsies were taken at 2 standardized sites across the middle region of the fetal side of the placenta and one biopt from the maternal side, approximately 4 cm away from the umbilical cord. The first biopsy was taken to the right of the main artery, the second in the third quadrant of the placenta. Gene expression in the neurotrophin signaling pathway of BDNF was explored using qPCR. Results Preliminary results on 40 individuals indicate a decrease of placental BDNF expression. A 5 µg/m³ higher exposure to PM2.5 during the first trimester of pregnancy was associated with a 19.0% (p=0.009) decrease in expression of BDNF. Expression levels were more decreased at the maternal side (24.1%) (p=0.005) compared with the fetal side (10.9%) (p=0.15). Moreover birth weight intended (p=0.08) to be positively associated with the placental BDNF expression levels. Conclusion Our preliminary data indicate a potential influence of maternal air pollution on placental gene expression of BDNF. These results will be further elucidated in a larger sample.

Abstract Number	**P-2-26-15**
Presenter	Andrea A Baccarelli*, Laura Cantone, Laura Angelici, Valentina Bollati, Matteo Bonzini, Pietro Apostoli, Armando Tripodi, Pietro Alberto Bertazzi
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Plasma circulating histones and blood clotting – A novel potential epigenetic mediator of PM effects

Background: Epidemiological findings have shown associations of particulate matter (PM) exposure with hypercoagulability and thrombosis. Extracellular circulating histones have recently been identified as novel mediators of inflammatory and procoagulant responses. However, the roles of extracellular histones in PM-related hypercoagulability have yet not been investigated. Aims: In 63 steel workers, we evaluated the effects of exposure to PM and PM metal components on two extracellular histone modifications (H3K4me3 and H3K9ac); and the association of H3K4me3 and H3K9ac with coagulation markers. Methods: Extracellular H3K4me3 and H3K9ac were determined in plasma through enzyme-linked immunosorbent assays. Coagulation markers included Endogenous Thrombin Potentials (ETP), tissue-type plasminogen activator antigen (t-PA) and D-dimer. Exposure to PM with aerodynamic diameters <1 µm (PM1) or <10 µm (PM10), and the PM10 metal components was estimated for each participant. Results: PM1 exposure was associated with increased plasma H3K4me3 and H3K9ac (β=0.20, p=0.02; β=0.16, p=0.05, respectively). H3K4me3, but not H3K9ac, was associated with zinc (β=0.13, p=0.03) and iron (β=0.32, p=0.01) contained in PM. ETP, measured in the presence of soluble thrombomodulin (ETP TM+), showed significant positive associations with PM1 (β=107.84, p=0.03), PM10 (β=83.06, p=0.02), and zinc (β=75.14, p=0.03); and a marginal association with iron (β=122.58, p=0.07). ETP TM+ was increased in association with higher plasma H3K4me3 (β=0.50, p=0.05) and H3K9ac (β=0.54, p=0.05). Additional PM effects, unrelated to extracellular histones, were observed on t-PA, D-dimer, and ETP TM. Conclusions: This observational study indicates potential roles of extracellular histones in mediating PM-induced hypercoagulability. Mechanistic studies are warranted to determine causality of these findings

Abstract Number	**P-2-26-16**
Presenter	Kelly Brunst*, Srimathi Kannan, Hope Padilla, Lauren Ross, Rosalind Wright
Exposure	ambient air pollution
Health domains	equity
Type of research	cohort study

Racial/ethnic differences in prenatal dietary intake of antioxidants and methyl-donors: Implications for environmental health risk

Background: Oxidative stress and epigenetic changes are key mechanisms for environmental exposures, including ambient air pollution. Antioxidants and methyl-donors may modulate toxic effects. Aim: We examined correlates of total dietary intakes of antioxidants and methyl-donors in an urban, ethnically mixed prenatal cohort (n=275) designed to study the effects of traffic-related air pollution, social stress, and dietary factors on prenatal programming of autonomic function. Methods: Total daily antioxidant and methyl-donor intakes were calculated from a food frequency questionnaire. Estimated Average Requirements indexed antioxidant/methyl-donor inadequacy (≥2 micronutrient inadequacies per group). Stress was indexed by negative life events. We examined differences in dietary intakes based on race and stress levels. Race-stratified logistic regression was used to examine effects of social stress on antioxidant and methyl-donor inadequacy adjusting for maternal education and body mass index. Results: Women were largely minority (43% Hispanic, 18% black, and 8% mixed). Vitamins E, folate, B6, and trace minerals zinc, magnesium, and iron were the most prevalent inadequacies. Differing antioxidant and methyl-donor intakes were observed by race, with blacks and Hispanics consistently having lower intakes than their counterparts (p<0.01). Higher stress was associated with antioxidant and methyl-donor inadequacy, particularly among blacks [odds of antioxidant (aOR: 2.09, 95% CI 1.15-3.80) and methyl-donor (aOR: 2.22, 95% CI 1.16-4.25) inadequacy]. Conclusions: Observed racial differences in dietary intakes of antioxidants/methyl-donors may, in part, explain differences in vulnerability to environmental toxicants (e.g., traffic pollution) and consequent health disparities. Next steps will include assessing modifying effects of dietary inadequacies on the role of traffic pollution-related fetal programming across racial groups.

Abstract Number	**P-2-26-17**
Presenter	Sharine Wittkopp*, Norbert Staimer, Thomas Tjoa, Daniel Gillen, Nancy Daher, Martin Shafer, James J. Shauer, Constantinos Sioutas, Ralph Delfino
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Single nucleotide polymorphism ?617 C/A in the Nrf2 gene promoter modifies gene expression-air pollution relationships in subjects with coronary artery disease

Background: We previously found positive associations between traffic-related air pollution exposures and gene expression in Nrf2-mediated antioxidant response genes and other genes. We hypothesize that genetic variation in NRF2 will alter relationships between pollutant exposure and expression of Nrf2-mediated genes. Aims: We aimed to determine if the -617C>A SNP in the Nrf2 promoter, a polymorphism shown to decrease binding and promoter activity, modifies our prior pollutant-gene expression relations. Methods: We measured whole blood gene expression levels weekly (12 weeks) in 40 subjects with coronary heart disease living in retirement communities in the Los Angeles area. We measured outdoor air pollutants: size-fractionated PM (including quasi-ultrafine PM<0.25µm), elemental and organic carbon (EC, OC), black carbon (BC), polycyclic aromatic hydrocarbons in PM (PAH), and gases (NOx, O3). We estimated primary and secondary OC (OCpri, SOC) from total OC. We genotyped the -617 position of NRF2 by sequencing. We used mixed effects regression models to test effect modification with pollutant*genotype interaction terms. We tested informative genes from our prior analysis: NRF2, HMOX1, SOD2, NQO1, GCLC, GCLM, CAT, GSTP1, CYP1B1, IL1B and SELP. Results: We identified 8 carriers of the risk allele (8AC, 0AA) and 32 non-carriers (CC). We found pollutant-genotype interactions for NRF2, SOD2, CYP1B1, NQO1, IL1B and SELP. In 617A carriers, NRF2 expression was lower in association with several pollutants. For SOD2, carriers had higher expression with exposure to traffic pollutants including: qUFP, PAH, EC, BC, OCpri, and NOx; as well as OC and SOC. Among carriers, we found increased IL1B and SELP, and decreased CYP1B1 with exposure. Conclusion: Overall, we found complex relationships with possible support for both a direct (CYP1B1) and an indirect role (SOD2, IL1B and SELP) of Nrf2 in mediating the gene expression changes associated with air pollution exposure.

Abstract Number	**P-2-26-18**
Presenter	Siying Huang*, Marc G Weisskopf, Bhramar Mukherjee, Jennifer Weuve, Linda Huiling Nie, Marie-Helene Saint-Hilaire, Lewis Sudarsky, David K. Simon, Bonnie Hersh, Joel D. Schwartz, Howard Hu
Exposure	gene-environment interactions
Health domains	neurodegeneration
Type of research	case-control study

The potential influence of variants of the SNCA gene on the impact of cumulative lead exposure on risk of Parkinson's disease

Background: The mechanism on genetic predisposition interacting with environmental lead exposures contributing to the risk of Parkinson's disease (PD) remains unclear. Aim: The aim of this analysis was to explore the effect of genetic variants of SNCA gene interacting with the environmental lead exposure on PD development. Methods: Data from of 328 newly identified PD cases and 207 controls in the Parkinson's Disease Gene-Metal Exposure (PD-GME) case-control study was used in this analysis. Environmental Lead exposure was measured at tibia and patella bone sites in consented subjects using 109Cd K-shell X-ray fluorescence. Fourteen candidate single-nucleotide polymorphism (SNP) markers in SNCA gene from 535 study subjects' DNA samples were genotyped using Sequenom iPLEX SNP genotyping technique. Logistic regressions adjusted for gender, race, pack years of cigarette smoking and educational levels were constructed to explore the interactions between lead exposures and SNCA variants. Results: We observed strong and significant main effects of markers at rs11931074, rs356186, rs1812923, rs10005233, rs2301135, rs2301134, and rs2736994 on PD development (p<0.05). After adjusting for linkage disequilibrium, we found that individuals carrying minor alleles in rs1812923 and rs2301135 had lower odds of PD, however the odds increased with elevated tibia lead level (p<0.05). Subjects carrying deleterious (major) alleles in these loci did not exhibit increased odds of PD with increased levels of bone lead. Conclusions: Lead increases the odds of PD only among subjects carrying non-deleterious allele. Subjects with higher genetic susceptibility were less affected by lead exposure. These results are clearly preliminary and in need of further replications.

Abstract Number	**P-2-26-19**
Presenter	Eric Vigoren, William Griffith, Beti Thompson, Gloria Coronado, Elaine M Faustman*
Exposure	gene-environment interactions
Health domains	neurobehavioral effects
Type of research	cohort study

Using GxE Approaches to Link Biomarkers of Exposure and Effect for Organophosphate Pesticides in Agricultural Community Households

Exposure biomonitoring of organophosphate pesticides (OPs) is a common practice to ensure protection of agricultural workers. The University of Washington Center for Child Environmental Health Risks Research collected biological samples from farmworkers and non-farmworkers to investigate potential exposures to OPs during agricultural periods of OP application. A key focus of the study was to identify within and between person variability thus urine samples were collected every two days and were matched with blood samples and AChE measurements from the same time period. Urine samples were assayed for 6 diakyl metabolites of OPs and blood for parent compounds. To estimate the joint distribution of the metabolites and clearance rates, we used MCMC methods in a mixed effects model. Levels of metabolite DMTP in farmworkers were 19 times that of the non-farmworkers. Across all of the farmworkers (fixed effects), the clearance half-life of DMTP had a geometric mean (95% CI) of 3.6 (2.5, 6.0) days compared to the non-farmworkers who showed no clearance. The half-lives for individual farmworkers (random effects) varied between 1.5 days and no clearance. The shorter half-lives were seen in farmworkers who had higher first day concentrations of DMTP and farmworkers with no clearance with those who had lower first day concentrations. These results are consistent with a continuing variable level of occupational exposure of the farmworkers with some of the farmworkers having a higher exposure prior to our collection of urine. The pattern in the non-farmworkers is consistent with exposures to preformed metabolites of OPs through diet and other routes of non-occupational exposure. Our mixed effects model included genotyping data for metabolism genes, and we observed significant differences in the relationship of cytochrome P450 isoforms with exposure (DAP metabolites) and health impacts (AChE inhibition). (Supported by NIH grants P01 ES009601, P30 ES007033 and RD-834514, RD-831709, RD-832733 from USEPA.)

Abstract Number	**P-2-27-01**
Presenter	Holton Michael*, Evan Anderson, Robert Adams
Exposure	others
Health domains	other
Type of research	review

The Historical Understanding of Sanitation and Disease Control in New Jersey

Beginning in 1877 The New Jersey (United States) Department of Health began publishing annual reports on the health status of its residents. These reports were largely narrative and contained health statistics, descriptive epidemiology, investigation reports, and descriptions of interventions and controls implemented in New Jersey. Not surprisingly, diseases associated with sanitation, water supplies, and crowding are a central focus of the early reports. Further, predominant theories of disease distribution at the time implicated sanitation as a cause in many illnesses. This presentation will present a critical review of the annual reports of the New Jersey Department of Health from 1877 to 1920 summarizing the theories of disease distribution, the effect they believed sanitation played a role in disease, the methods used to control the spread of diseases, and the effectiveness of those controls. An understanding of the historical evolution of the understanding and controls of these diseases can be valuable to the development of programs to educate affected populations and control these diseases in developing countries where resources and infrastructure may be at similar stages of development. It will also serve to show the development of epidemiological principles and practices during the rise of industrialization.

Abstract Number	**P-2-28-01**
Presenter	Noa Krawczyk*, Armando Meyer, Maíra Fonseca, Jaime Lima
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	health impact assessment

Suicide mortality among agricultural workers in a region with intensive tobacco farming and use of pesticides in Brazil

BACKGROUND: Pesticide poisoning is a known occupational hazard that has been associated with both depression and suicide. Little research has been done on neurobehavioral effects and mental health of tobacco agricultural workers who are simultaneously exposed to pesticides and to toxins in tobacco leaves. AIMS: An ecological study was designed to analyze suicide mortality patterns among agricultural workers and investigate whether suicide risk is exacerbated in regions with higher pesticide use and/or presence of tobacco farming. METHODS: Suicide mortality data was gathered for residents of different cities in the Northeastern Brazilian state of Alagoas. Agricultural census data was used to determine the presence of tobacco farming and the amount of pesticides used in each city, and mortality odds ratio calculations were employed to compare suicide risks between workers in different cities. Distributions were made for different variables and interquartile comparisons were performed according to different exposure degrees. Differences in suicide risk were noted between a. agricultural and non-agricultural workers, and b. agricultural workers living in cities with different levels of pesticide use and tobacco farming. RESULTS: Overall, agricultural workers showed higher risk of death by suicide than non-agricultural workers. Among agricultural workers, risk of death by suicide was elevated in cities that use more pesticides, and greatest in cities that use pesticides and produce tobacco. CONCLUSIONS: This is one of the first studies of its kind to suggest that synergic effects of pesticides and tobacco exposure may be linked to increased suicide incidence among agricultural workers. Further investigation of the interaction and toxicity of these factors is needed in order to implement more appropriate regulations that will protect the health of workers and populations living in cities surrounding agricultural areas with intensive tobacco farming.

Abstract Number	**P-2-29-01**
Presenter	Stephen Rauch, Sarah B. Henderson*
Exposure	ionizing radiation
Health domains	no health domain
Type of research	exposure measurement

A comparison of two methods for ecologic classification of radon exposure in British Columbia: residential observations and the radon potential map of Canada

Background: Radon is a colourless, odourless, naturally-occurring radioactive gas that causes lung cancer. Few epidemiologic studies of radon exposure have been performed in Canada; studies with ecologic exposure assessment may provide some advantages. Aims: To compare ecologic classification of radon exposure from observed residential concentrations in BC with classifications based on a map that shows geological radon potential, with particular attention to high-smoking populations. Methods: First, residential radon measurements from four health agencies were used to classify 74 local health areas (LHAs) as low, moderate, or high exposure based on the number of homes with concentrations greater than the Health Canada action guidelines of 200 and 600 Bq/m3. Second, the Zone 1 (high), Zone 2 (elevated), and Zone 3 (guarded) risk categories of the radon potential map of Canada were used to make the same exposure classifications based on the population-weighted area of each zone in each LHA. Agreement was compared and quantified. Average smoking rates in each LHA were used to further assess agreement for smokers, who are a high risk group. Results: Both methods showed a range of exposures across LHAs. The radon potential map classified more areas as high exposure than the observed radon concentrations, and the methods agreed in 30 of 74 LHAs. The radon potential map identified much of the southern coastal region as high exposure, but 617 of the 621 observed concentrations were ≤200 Bq/m3, and no observations were >600 Bq/m3. An estimated 36% of the BC population and 35% of BC smokers live the southern coastal region. Conclusions: The radon potential map of Canada may communicate potential radon risk, but it was not designed for epidemiologic exposure assessment. Overall, the potential map classified 34 LHAs as higher than observed, and 10 LHAs as lower than observed. The potential map should only be used to inform exposure assessment in conjunction with observed radon concentrations.

Abstract Number	**P-2-29-02**
Presenter	Tom De Smedt*, Koen Simons, André Poffyn, Julie Francart, An Van Nieuwenhuyse
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

Alleviating ecological bias in linking radon exposure to health outcomes

Alleviating ecological bias in linking radon exposure to health outcomes Background Associations between radon exposure and health outcomes are usually assessed via standardized rates or regression coefficients stemming from generalized linear models (GLM) in ecological studies. There is one limiting factor in these studies: the high within-area variability of radon concentrations gives rise to ecological bias. In Belgium the indoor radon concentration can range from 0 to 4205 Bq m-3 within one commune. Radon is a prime candidate for alleviating this bias by using the actual within-area distribution as in many countries the indoor Radon concentrations in high risk areas are monitored. Aims Development of an alternative methodology to alleviate ecological bias in ecologic studies concerning radon, using the aggregated individual risk instead of the GLM. We will compare these methodologies using skin cancer incidence in Belgium. Methods Our method consists of calculating the aggregated individual risk in the geographical unit by integrating the product of the individual binomial risk and the exposure distribution in the unit. The resulting model is a function of the relative risk associated with the radon exposure. We can estimate the relative risk by maximizing the binomial likelihood using the aggregated individual risk. The aggregated model has theoretically less ecological bias due to within-area variability than GLMs. In recent years the computational power has risen to the level necessary to perform the numerical integration to calculate the aggregated individual risk. We will compare our method to the GLM by using the indoor concentrations of radon per commune and the skin cancer incidences in Belgium, in addition to simulated data. Conclusions We use the actual within-area distribution of the radon exposure to alleviate ecological bias.

Abstract Number	**P-2-29-03**
Presenter	Rakhmanbek Toichuev*, Gulnara Toichueva, Janyl Madykova, Aida Mamatzhan kyzy, Timur Payzyldaev
Exposure	metals
Health domains	autoimmune disease
Type of research	exposure measurement

Characteristics of the level of thyroid hormones without clinical manifestations of goiter in population living in uranium biogeochemical zone.

Objective: to study the characteristics of the level of thyroid hormones without clinical manifestations of goiter in population living in uranium biogeochemical zone.Materials and methods: A total of 81 patients aged 2 to 25, without clinical manifestations of goiter were subjected to examination. All patients were the residents of the town of Mayluusuu, where more than 10 th. tons of uranium ores were extracted from 1946 to 1968. At present, there are 16 tailing dumps and 23 tailing pits in the region. The levels of thyroid stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), thyroglobulin (Tg) and thyroidperoxidase antibodies in blood serum were evaluated by immunofluorescence assay. Results: No patients under examination showed levels of thyroid hormones within the normal range. TSH levels above the normal range (4.00 mIU / L)was detected in 2 (2.47%) patients, below the normal (0.1 mIU / L), i.e. characteristic of primary hyperthyroidism - in 2 (2.47%).T3 levels below normal (0.03 nmol / l) were in 41 (50.6%) patients and above norm (3.9 nmol / L) in 3 (3.7%).T4 levels below normal (65.4%) were found in 53 patients, above normal (3.7%) – in 3 (3.7%).Forty one patients (50.6%) showed Tg level above normal (90.90 ng /ml), with average level M 52.19 ± 8.15, P <0.001. According to the WHO, since 1994, increased average level of Tg in blood has been considered one of the indicators of endemic goiter.The levels of thyroidperoxidase above normal were detected in 41.85%. Accuracy rate M = 38.24 ±; 12.67, P <0.001. Elevation of threshold indicates autoimmune process and autoimmune thyroid diseases (idiopathic myxedema, Hashimoto's thyroiditis, Graves' disease).Conclusion: Thus, the levels of thyroid hormones were above or below the normal ranges in people living in uranium biogeochemical zone including those who demonstrated no clinical manifestations of goiter. Hyperthyroidism accounts for 3.7% and autoimmune thyroid diseases - 41.85%.

Abstract Number	**P-2-29-04**
Presenter	Ben D Spycher*, Judith Lupatsch, Matthias Egger, Martin Röösli, Dimitri D Hauri, Claudia E. Kuehni
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

Childhood cancer and background gamma radiation: a census-based cohort study

Background It is established that exposure to high doses of ionizing radiation increases the risk of leukaemia in children. Evidence for effects of low dose exposure is limited. Few studies have investigated the effects of background gamma radiation (cosmic or terrestrial) on the risk of childhood cancer. Aims To investigate whether the risk of childhood cancer is associated with exposure to natural gamma radiation measured at children's homes. Methods We calculated person years at risk of children in Switzerland aged <16 years for the period 1985 to 2009 using data from the Swiss censuses 1990 and 2000. Cancer cases were identified from the Swiss Childhood Cancer Registry. Geocoded addresses of residence were available for the whole population at census and at diagnosis and birth for cases. Outdoor gamma ray exposure was calculated for these locations as the sum of cosmic and terrestrial dose rates using previously developed radiation maps (Rybach et al. J Environ Radioactivity 2002). We estimated incidence rate ratios (IRRs) for different exposure categories using Poisson regression adjusting for calendar year, age and sex. Results Analyses were based on 4246 cases and 13.6 million person years of follow-up. Mean (median) dose rate in the population was 109 nSv/h (103 nSv/h). Compared to the exposure category 50-100 nSv/h, IRRs (95% CIs) for any cancer were 1.33 (0.99-1.78) and 1.21 (0.63-2.33) for categories 200-250 and >250 nSv/h, respectively, when using addresses at diagnosis. When using addresses at birth, corresponding IRRs were 1.39 (0.98-1.96) and 1.95 (1.01-3.76). For leukaemia, there was little evidence of an association. However, incidence of CNS tumours was increased in these exposure categories, particularly when using addresses at birth: 1.83 (0.94-3.57) and 4.19 (1.56-11.3). Conclusions Our findings suggest that background gamma radiation contributes to the risk of cancer in children. Evidence was strongest when using exposure at birth and for CNS tumours.

Abstract Number	**P-2-29-05**
Presenter	Thomas-Baptiste DE BROUWER*, Myriam ELENGE MOLAYI, Christophe DE BROUWER
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

Collective dose and dosimetry

Background: Epidemiological surveillance of occupationnal exposure to ionizing radiation is ultimately limited mainly to the stochastic risks of chronic diseases (eg. cancer). Passive dosimetry (the badge dosimeter) used for this purpose, gives various measures which will represent the dose at 1 cm depth (HP10). The collective dose, base of reasoning to estimate the risk of a group, is calculated from this measurement, and the use of LNT model. Aims: The equivalence between the dose at 1 cm depth (HP10) and effective dose, is it justified? Methods: Effective doses are calculated from a weighted sum of the doses really received by different organs (gonads, bone marrow, colon, lung, ...) in a person. The dose recorded by the dosimeter badge HP10 is considered representative of the effective dose. Results: The ICRP and ICRU showed that the dose at 1 cm depth almost systematically overestimated the effective dose, which is conservative. This overestimation is marked for the irradiation of low energy photons (radiology). It can vary by a factor of two to three in some conditions. On the contrary for irradiation of high-energy photons (radiotherapy), the opposite effect is observed. The effective dose is then underestimated and sometimes of a factor two! Conclusion: The relationship between dose and effective dose measured at 1 cm depth is not as obvious as it seems. The collective dose which would derive from it, introduces deviations from the calculated dose using passive dosimetry which would not be negligible in term of risk factors for chronic diseases.

Abstract Number	**P-2-29-06**
Presenter	Yousun Ko*, Eun Shil Cha, Mina Ha, Seung-Sik Hwang, Kyoung-Mu Lee, Won Jin Lee
Exposure	ionizing radiation
Health domains	other
Type of research	cohort study

Comparison of four survey methods to enroll radiologic technologists in South Korea

Background:Various survey methods apply for data collection in epidemiological researches. Since each method has both weakness and strength, it is important to identify appropriate method for region, subjects, and period- specific methods. Aim: The aim of this study was to compare four survey methods in the radiologic technologists' cohort in South Korea. Methods:We have conducted the self-administered questionnaire survey through postal, on-site visits, fax and web-based methods. We evaluated response quality and cost-effectiveness for four methods of survey administration, and compared response rates by hospital size among subjects recruited by postal survey. Results:We have enrolled a total of 10,531 radiologic technologists working in South Korea in 2012. The postal survey (52.9%) has occupied the highest response method, followed by the web (27.4%), fax (10.7%), and on-site (9.0%). The response quality, which was evaluated by the item completeness, was the highest in web-based survey (≥97.5%) and the lowest in on-site survey (41.9%). The fax survey was the most cost-effective method ($0.45 per subject), followed by on-site survey ($0.57), and web-based survey ($2.89) was the most expensive. The postal survey was with an average of 6.4 days to respond. The response rate was significantly increased with hospital size among postal survey. Conclusion:Our findings suggest that the postal survey is better than other types of survey methods in terms of accessibility, data quality and cost-effectiveness for enrolment of radiologic technologists in South Korea.

Abstract Number	**P-2-29-07**
Presenter	Esther Erdei*, Robert Rubin, Curtis Miller, Jennifer Ong, Bernadette Pacheco, Miranda Cajero, Christopher Shuey, Johnnye Lewis
Exposure	metals
Health domains	autoimmune disease
Type of research	cross-sectional study

Immune System Responses Related to Environmental Uranium Exposures ? DiNEH Project Results

Background Navajo community members living on the Southwest US are concerned that environmental uranium exposures may be contributing to chronic and possibly also to infectious diseases through several toxicological pathways (water consumption, dust inhalation and radiation exposure). Aims Based on our previous work on immune responses to heavy metal exposures in another Native population in South Dakota, we initiated preliminary immune function studies among a subset of DiNEH project participants (n=268) to examine possible etiologies of autoimmune disease. Methods Statistical modeling of the survey data (N=1,304) and geospatial data on the locations of uranium wastes and participants' homes indicated an association between environmental uranium exposures and self-reported autoimmune disease. We performed flow cytometry determining lymphocyte subpopulations; measured 10 serum cytokines and auto-antibodies in collected blood samples to investigate immune system responses. Regression modeling was performed on these cellular measures to examine associations with environmental uranium exposure. Results indicate that DiNEH participants who reported increased environmental uranium exposure (based on calculated weighted distance from waste sources) had increased proportion of activated T cells and decreased activity of B cells and other antigen-presenting cells. This cellular change can lead to lower production of protective antibodies. Alterations in cytokine production were indicative of the presence of an inflammatory response. Increased prevalence of serum autoantibodies also supports an association between metals and autoimmunity. Conclusions This work identifies altered immune responses among Navajo community members who are currently or previously have been exposed to various sources of environmental uranium waste. The DiNEH Project grants:NIEHS RO1 ES014565; R25 ES013208; P30 ES-012072; USEPA/ERRG; DHHS/NIH/NCRR#1UL1RR031977-01.

Abstract Number	**P-2-29-08**
Presenter	Eileen Pernot, Horst Zitzelsberger, James Grellier*, Maxim Lushchyk, Yuri Demidchik, Elisabeth Cardis
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

INT-Thyr: Integrating radiation biomarkers into the epidemiology of post-Chernobyl thyroid cancer in Belarus

Background Extensive epidemiological studies have confirmed an increase in thyroid cancer incidence in regions contaminated by the Chernobyl accident, and have demonstrated that this is mainly related to radiation doses received from incorporated radioiodines. Two potential biomarkers of radiation-induced thyroid cancer have been identified previously—7q11 gain and CLIP2 overexpression—among thyroid cancer patients that were exposed to fallout from the Chernobyl accident. Aims We aim to validate these potential radiation biomarkers in a cohort of post-Chernobyl childhood thyroid cancer patients from Belarus, to study potential associations of these markers with dose and age at exposure, to evaluate possible effect modifiers. Methods Gain in 7q11, CLIP2 overexpression and other potentially interesting radiation biomarkers will be investigated by FISH and transcriptional analyses in tumour samples from the cohort. Estimates of dose of radioactive iodine isotopes, long-lived radionuclides and external radiation—as well as index of iodine deficiency—will be assigned to each subject in the cohort. We will ascertain whether these biomarkers of radiation-induced thyroid cancer are dose-dependent, and will investigate effects of possible modifiers, including age, iodine deficiency and sex. Results Since May 2012, 130 Belarusian patients for whom biological samples are available have been identified. Standardization of CLIP2 overexpression assay by immunohistochemistry is ongoing. Conclusions The increase in incidence of thyroid cancer in young people in regions most contaminated by fallout from Chernobyl represents a unique opportunity to study mechanisms of radiation-induced thyroid cancer. The identification of biomarkers that can be integrated into epidemiological studies is of great importance for better understanding the molecular mechanisms of carcinogenesis following low dose irradiation. It is important to validate these potential biomarkers and evaluate their relationship with dose and any other factors which may influence this.

Abstract Number	**P-2-29-09**
Presenter	Meeseon Jeong*, Han Na Kim, Eun Sook Park, Mi-Kyung Cheon, Tae-In Choi
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

Lifetime Cancer Risks Attributable to Radiation Exposure of Korean Population based on the Risk Models in BEIR VII

Background: Radiation-induced lifetime cancer risk is a useful measure to predict cancer risk of population or individual exposed to radiation accidently, medically, or occupationally. Aims: To evaluate the lifetime risk of cancer incidence and mortality following exposure to ionizing radiation for Korean population. Methods: The lifetime attributable risk (LAR) was calculated with its uncertainty using the method by BEIR VII committee. Based on recent baseline cancer rates and the life table for Korean, the LAR was calculated under three artificial scenarios for exposure to ionizing radiation. Results: When a Korean population of 100,000 persons was exposed to a single dose of 0.1 Gy, the estimated excess of incident cases for solid cancers, that is, LAR was 966 (95% CI: 469-1,989) for males and 1,104 (95% CI: 536-2,274) for females. Under the same exposed population the excess of leukemia was estimated at 66 (95% CI: 15-288) for males and 48 (95% CI: 12-200) for females. As a whole, assuming a sex and age distribution of the Korean population, approximately 34 of 100 people would be diagnosed with cancer from causes unrelated to radiation in a lifetime while approximately 1 cancer could be added by a single exposure 0.1 Gy. Similarly, when a Korean was exposed to 1 mGy per year throughout life or occupationally to 10 mGy per year from ages 20 to 60, the excess of cancer incidence in a lifetime was estimated at 0.8 or 3.5 per 100 people, respectively. For cancer mortality, the estimated LAR showed similar attributable fraction to that of cancer incidence for each condition. Conclusion: We evaluated the site-, sex-, and age-specific lifetime cancer risk attributable to radiation exposure for Korean population. The results of this study can be used to provide the guidance for monitoring of nuclear workers and also to predict cancer risk for patients associated with CT-scan or residents living in area environmentally contaminated in case of radiation accidents in Korea.

Abstract Number	**P-2-29-10**
Presenter	Kyung-Hwa Choi*, Won Jin Lee, Seung-Sik Hwang, Kyoung-Mu Lee, Eun Shil Cha, Yousun Ko, Mina Ha
Exposure	ionizing radiation
Health domains	cardiovascular disease
Type of research	cohort study

Occupational Radiation Exposure and Metabolic Risk Factors of Cardiovascular Diseases in Radiologic Technologists in South Korea

Background: There has been reported that radiation exposure increases the risk of cardiovascular disease. Radiologic technologists are the highest exposed group among diagnostic radiation workers. Aims: To investigatean association between the occupational radiation exposure and metabolic risk factors for cardiovascular diseases among radiologic technologists in Korea. Methods: A total of 8,101 radiologic technologists were included in this study (5,839 males and 2,262 females) among 10,531 baseline cohort of the Radiologic Technologists' Health Study in South Korea, after excluding those with missing information. Median (range) of follow-up time is 11.3 (0.2-16.0) years in male and 6.4 (0.1-16.0) years in female. We linked the data of the National dose registry (1996-2011) and the National health examination data (2006-2011). Relative risks of having metabolic risk factors for cardiovascular diseases for the average annual effective radiation dose were calculated using Cox proportional hazard model adjusted for age, smoking, alcohol intake, exercise, disease associated metabolic risk factors, behavior of wearing dosimeter, and year of starting radiology work. Results: In male workers, relative risk of having high fasting blood glucose (≥110 mg/dL) was increased by 10% significantly according to the 1mSv increase of average annual effective dose and those of having obesity (BMI ≥25 kg/m2), low HDL cholesterol (<40 mg/dL), and high triglyceride (≥150 mg/dL) were increased by 4%, 6%, and 6% for 1mSv increase of annual occupational radiation exposure, respectively. In female workers, risks of having high fasting glucose and obesity were increased by 16% and 14% for an increase of 1 mSv of annual effective dose of occupational radiation exposure, respectively. Conclusions: The risks of having metabolic risk factors for cardiovascular disease were significantly increased according to increase of average annual exposure dose of occupational radiation in Korean radiologic technologists.

Abstract Number	**P-2-29-11**
Presenter	Xiaochen Shu*, Maria Feychting, Martin Röösli, Joachim Schüz, Tore Tynes
Exposure	ionizing radiation
Health domains	cancer
Type of research	case-control study

Pre/peri- or postnatal medical history on the risk of brain tumors in children and adolescents: reports from CEFALO multicenter case-control study

Background: The effect on childhood brain tumor risk from medical history during a sensitive period of neural development remains unknown. Aims: Our aim was to investigate whether pre/peri- or postnatal medical history affects the risk of pediatric brain tumors. Methods: Data were derived from CEFALO, a multicenter case-control study conducted in Denmark, Norway, Sweden, and Switzerland including all persons aged 7 to 19 years diagnosed with a primary brain tumor from 2004 to 2008. For each case two population controls matched on sex, birth year, and region were randomly selected. Medical history and treatments were identified through personal interviews with 352 (83%) cases and 646 (71%) controls, and their parents. Results: X-rays, scans or ultrasound during pregnancy, perinatal hypoglycemia or jaundice, fever during the first 12 weeks, postnatal general anesthesia, or febrile seizures were not associated with the risk of pediatric brain tumors. Postnatal exposure to any type of X-ray or scan was associated with a slightly reduced risk estimate, while head CT/PET scans was associated with a two-fold risk increase, none of them statistically significant although borderline. No association was observed with MRI scans to the head. Some indications of increased risk of pediatric brain tumors after head injury were observed. Conclusions: The pattern of the results indicate a possibility of recall bias when reporting post-natal medical radiation for diagnostic purposes as well as head injury, although the difference between risk estimates for head CT/PET compared to head MRI are noteworthy. Also, the possibility of chance findings due to limited numbers of exposed cases cannot be ruled out.

Abstract Number	**P-2-29-12**
Presenter	Seung-Sik Hwang*, Myoungsoon You, Won Jin Lee
Exposure	ionizing radiation
Health domains	other
Type of research	cross-sectional study

Risk perception and feeling of worry of radiation exposure at work : A case of radiologic technologists in South Korea

Background:Despite increasing concerns about radiologic technologists (RT), the occupational group exposed to the highest dose of radiation worldwide, little is known about the factors affecting their thoughts and feelings of risk at work. Aims: To fill this gap, this study attempted to (1) identify key variables predicting perceived risk and worry among RT, and (2) provide implications for improving organizational communications between health experts including RT and managers. Methods: A nationwide representative survey of RT (N=585) was conducted in 2012 using a stratified multistage random sampling design. Both qualitative and quantitative data were collected by face to face interviews. Questionnaires consisted of (1) risk ratings, (2) risk perception of radiation exposure at work (3) affect, value, trust(e.g. toward experts), worry and intention to quit RT work, and (4) job related factors(e.g. tenure) as well as demographic variables Results:For RT that routinely working with radiation technologies and equipment, neutral (53.7%) or positive (31.7%) rather than negative (14.6%) affective image of radiation risk was dominant. Risk of radiation exposure was differently perceived: it was the second-lowest as a general risk, but ranked in the top three when it was considered as ‘my risk’. Results of multiple regressions showed that ‘organizational trust’, the extent to which RTs believe in their hospital’s efforts for timely and effective risk management of radiation exposure, was the strongest predictors of both risk perception and worry of radiation exposure at work. Conclusions: Consistent with the literature on risk perception, findings of this study suggested that the same risk can mean different things in different contexts. In particular, this study highlighted the importance of organizational trust in risk perception and job related worry. For a healthier occupational environment, hospital managers need to be aware that trust can play a role in work safety and psychological well-being among health experts.

Abstract Number	**P-2-29-13**
Presenter	Sylvie Martin*, Lucile Offredo, Claire Ségala
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

Study of long duration diseases in the cohort of veterans with dosimeter testing during the French nuclear tests in the Pacific.

Background: Following a mortality study in a cohort of male veterans present on the sites of the French nuclear experiments in the Pacific from 1966 to 1996, a morbidity study was conducted based on long duration disease (LDD) recognized by the French Social Security Aims: To evaluate the hypothesis of a higher LDD frequency in veterans still alive in January 2003, than in French population. Method: Admissions to LDD were compared between veterans and French population for 2003-2008 period by indirect standardization. The comparison within the cohort, of two groups according to radiations exposure, respectively with (DP) and without (DN) dosimeters above the detection threshold, was performed by Poisson regression with adjustment on age, period of admission in LDD, army and region of birth. Results: 18 717 veterans were enrolled, including 9% in the DP group. 4887 new LDD were taken up (for 3 584 men), 91.5% in the DN group and 8.5% in the DP group. Frequency of LDD for all cancers (first cause of LDD) was the same as in the French population (SIR = 1.00 [0.95-1.06]), but LDD for prostate cancer was in excess in the cohort (SIR = 1.09 [1.00-1.19]). LDD for peripheral arterial diseases were in excess in the cohort (SIR = 1.18 [1.06-1.31]). The comparison of the frequencies of LDD within the cohort revealed excess of LDD in DP group for cancer of the peritoneum (RR = 18.13 [1.28-257.39]) and multiple sclerosis (RR = 3.47 [1.18-10.2]). Conclusion: In the cohort of veterans, excess of peripheral arterial disease and prostate cancers were found, but they remain to be explained as these diseases were not in excess in the most exposed group (DP). Excess of cancer of the peritoneum and multiple sclerosis in DP group should be interpreted with caution because of the small number of people affected by these diseases. This work was supported by OSV (Veterans Health Monitoring Centre)

Abstract Number	**P-2-29-14**
Presenter	Rakhmanbek Toichuev*, Erkin Tostokov
Exposure	ionizing radiation
Health domains	reproductive outcomes
Type of research	exposure measurement

The effect of low concentrations of radioactive nuclides on morphometric characteristics of human placenta.

Objective: To assess the effect of radioactive nuclides of uranium and thorium on the morphometric characteristics of human placentaMaterials and methods: The present study was performed on 67 placentas (Group I) of women with a normal pregnancy (38-41 weeks) living in the town of Mayluusuu (12-17 km downstream the uranium biogeochemical zone, where uranium ores were extracted for 22 years) and 48 placentas of women (Group II- control) living in ecologically-pure zone. Placentas were weighed on electronic scales, followed by length measuring. To detect the concentration of uranium and thorium, placentas were burned in a porcelain dish in muffle furnace at 400 - 600° C. X-ray spectrometry was used to analyze concentrations of uranium and thorium in the ashes. Results: In Group I, uranium and thorium were detected in all specimens of placenta. Uranium concentration levels ranged from 0.01 to 2.26 mg / kg (average concentration 0.73 ± 0.4), thorium - from 0.01 to 0.63 mg / kg (average concentration 0.25 ± 0.2), P <0.001. No traces of uranium or thorium were found in specimens of placenta in control group. Considering the fact that placental weight depends on the number of births, three groups were distinguished: primipara, secundipara and multipara. In Group I, placental weight was 477 ± 59 g (P <0.001) in primipara and 607 ± 164 g in multipara. In Group II – 415.12± 16.2 g and 478.35± 13.3 g (P <0.001), respectively. Besides, the weight of placenta was dependent on the concentration of uranium and thorium in placenta.Conclusion: Thus, the weight of human placenta containing radioactive nuclides is higher than that of placenta free from radioactive nuclides, i.e. even small concentrations of radioactive nuclides in placenta, possessing "excess" energy create conditions for accelerated cell division, and as a result, increased weight of placenta.

Abstract Number	**P-2-29-15**
Presenter	Hans-Peter Hutter*, Janie Shelton, Michael Kundi, Hanns Moshammer, Barbara Stöckl, Kathrin Piegler, Peter Wallner
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

The radiating K&K mining authority in Vienna: environmental radiological evaluation one century after the end of the Austrian monarchy

Background: Radon has been shown to increase the risk of lung cancer. In this study, employees working in the former K&K mining authority building in Vienna, Austria, requested an assessment of their health risk from their exposure to radon from the historical storage and sale of radium in the building (until 1914). Methods: Measurements (68 ambient dose rate and three radon measurements) were performed both inside (8 rooms) and outside of the building by a certified institute. Nuclides were identified by gamma spectroscopy. Radon concentrations in air were measured by Alphaspectroscopy (AlphaGuard©). Furthermore, the duration of exposure for employees at various work places in the past four years was assessed. Results: The maximum ambient dose rates at the work places (office desks) were between 0.2 and 2.0 µSv/h. Higher values were measured in niches and on the floor (up to 300 µS/h). Ambient outdoor dose rates were below 0.08 µS/h. Ra226 was identified as major nuclide. Rn-levels were above 240 Bq/m³. The longest duration of exposure at the work places was approx. 480 hours (over four years). After adjustment for the different locations a total exposure of approx. 240 µS was calculated for that employee. Discussion: Compared to the local ambient background levels around the building, a significantly higher exposure was detected in the offices. The total dose in two office rooms was also above the threshold values for the general population (1 mSv/a). The excess unit lifetime risk for the employee based on an additional exposure to 240 µSv is by application of a linear no-threshold model 1.32x10-6. Applying a preventive approach the use of the office rooms as permanent working places should be restricted.

Abstract Number	**P-2-29-16**
Presenter	Won Jin Lee*, Mina Ha, Seung-Sik Hwang, Kyoung-Mu Lee, Young-Woo Jin, Meeseon Jeong, Eun Shil Cha, Yousun Ko, Kyung-Hwa Choi, Jung-Eun Lee
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

The Radiologic Technologists Health Study in South Korea: Study Design and Baseline Characteristics

Background: Radiologic technologists occupy the largest group among medical radiation workers and they are one of the occupational groups exposed to the highest dose of radiation worldwide. Therefore, we have launched a prospective cohort for radiologic technologists to investigate occupational radiation exposure status, and to assess their health effects in relation to occupational radiation exposure in South Korea. Aims: To describe the study design, methods, and the profile of the cohort participants Methods: Baseline data for the participants were derived from the self-administered questionnaire survey through website, on-site visits, fax, and mail in 2012. A nationwide representative survey of radiologic technologists was also conducted using a stratified random sampling design. For this survey, face-to-face interview method was adopted and buccal cell was collected for DNA extraction. We linked the data obtained by the questionnaire with the national radiation dose registry (1996-2011) and secondary health data including the national cancer registry (up to 2009), national health insurance claims and health examination data (2006-2010). Results: A total of 11,772 radiologic technologists were enrolled, which accounted for about 60% of the total radiologic technologists working in South Korea in 2012. The majority of subjects was male (71%) and 40 or less years old (65%), and started radiation work after 2000 year (60%). About 83% of radiologic technologists had used a diagnostic X-ray, 40% had used a CT, and 26% had worked with fluoroscope. The average annual effective dose was 1.3 mSv in 2011, and 818 (7.8%) workers received more than 5 mSv per quarter. Radiologic technologists were reported to have less smoking and alcohol drinking, and less cancer and other chronic diseases than general population except thyroid diseases. Conclusion: This cohort has comprehensive information obtained from various sources, which is expected to be one of the valuable datasets to study low dose radiation exposure and health effects in an occupational setting.

Abstract Number	**P-2-29-17**
Presenter	Pai-Yue Lu, Leah Kottyan, Judith A James, Changchun Xie, Jeanette M Buckholz, Robert L. Herrick, John B Harley, Susan M. Pinney*
Exposure	metals
Health domains	autoimmune disease
Type of research	case-control study

Uranium exposure and systemic lupus erythematosus in a community living near a uranium plant

Background: Effects of environmental exposures on the development of systemic lupus erythematosus (SLE) are relatively unexplored in SLE pathogenesis. Methods: A nested case control study was performed with data from the Fernald Community Cohort (FCC), a volunteer population who lived within 5 miles of a uranium ore processing plant in Fernald, OH during plant operation (1951-1989) and followed 1990-2008 in a medical monitoring program. Uranium plant workers were excluded. Potential SLE cases were identified by ICD9 codes for lupus and a medication code search for hydroxychloroquine. Sera from potential cases were screened for autoantibodies using a multiplex immunoassay and anti-cardiolipin antibodies using ELISA. Cases were confirmed using American College of Rheumatology classification criteria and medical record documentation. Each case was matched to four age-, race-, and sex-matched controls. Cumulative uranium particulate exposure was calculated using a dosimetry model developed by the US Centers for Disease Control and Prevention. Logistic regression with covariates (smoking, alcohol, and family history of SLE) was used to calculate odds ratios (OR) with 95% confidence intervals (CI). Results: The FCC includes 4,187 individuals with background uranium exposure, 1,273 with moderate exposure, and 2,756 with higher exposure. SLE was confirmed in 23 of 26 cases with ICD9 code 710.0 or 695.4, and in 2 of 43 other cases prescribed hydroxychloroquine. The female:male ratio was 5:1. Of the 25 SLE cases, 12 were in the high exposure group. SLE was associated with higher exposure (OR 3.92, 95% CI 1.131-13.588, p = 0.031). Conclusion: Uranium exposure is associated with SLE cases relative to matched controls in this sample of uranium exposed individuals. Potential explanations for this relationship include the estrogen effects of uranium, somatic mutation from ionizing radiation, epigenetic effects, or effects of some other unidentified accompanying exposure.

Abstract Number	**P-2-29-18**
Presenter	Eun Shil Cha*, Mina Ha, Seung-Sik Hwang, Kyoung-Mu Lee, Meeseon Jeong, Won Jin Lee
Exposure	ionizing radiation
Health domains	no health domain
Type of research	cohort study

Work practices and occupational radiation dose among radiologic technologists in South Korea

Background: Radiologic technologists are one of the occupational groups exposed to the highest dose of radiation worldwide; however, few studies have been conducted for their work practices and related factors on occupational radiation dose. Aims: The aims of the study are to describe work practices and to assess related factors for occupational radiation dose among radiologic technologists in South Korea. Methods: A nationwide representative survey of radiologic technologists (n=585) was conducted using a stratified sampling design. Detailed occupational radiation exposure history by calendar periods was surveyed and the national dose registry data for 1996-2011 was linked with the questionnaire. Descriptive analysis for work practices and frequency of radiation work and linear regression analysis were performed to evaluate the related factors for occupational radiation dose. Results: Most radiologic technologists (92%) had worked with a routine diagnostic X-ray, 58% had used a CT, 44% had used a portable X-ray, and 41% had used a fluoroscopy. During the period from 1970 to present, an increasing trend was observed in the percentage of wearing the personal monitoring dosimeter, working with CT procedure and using of lead thyroid protector. The annual effective dose of the subjects has decreased from 2.90 mSv in 1996 to 1.47 mSv in 2011. The annual effective dose was significantly high in male, those aged 30-39 years, those worked for less than 5 years and worked for more than 60 hours per week. The occupational radiation dose was significantly increased with increase in work frequency with X-ray and CT procedure. Conclusions: This study showed the work practices and occupational radiation dose among representative sample of radiologic technologists in South Korea. The annual effective dose among radiologic technologists in South Korea remains higher compared with those of worldwide average and varied according to demographic factors, year began working, and duration of working.

Abstract Number	**P-2-31-02**
Presenter	Matthew O. Gribble*, Daniele R. Reed, Karen Bandeen-Roche, Pamela Dalton, Mary A. Fox
Exposure	organic compounds
Health domains	equity
Type of research	cross-sectional study

Demographic Subgroups Report Differential Use of Fragranced Products.

Background: Fragrance chemicals are added to chemical mixtures to change the smell. Different fragranced consumer products have different mixtures of fragrance chemicals, as well as different active ingredients. Thus, the context of a fragrance chemical varies across consumer products, and people can be exposed to the same chemical from different products. Aims: This study aimed to examine demographic differences in use of various fragranced products. Methods: N=280 white twins responded to paper questionnaire about use of fragranced products including perfume, shampoo, body wash, body lotion, hand soap, laundry detergent, kitchen/bathroom cleaners, furniture polish and floor polish. Frequency of use for each was modeled by mixed-effect ordered logistic regression with random effects for twin pair and sharing an address with twin. Fixed effects in the models were male gender, age over 50, (ordinal) level of education, and if ever bothered by fragrance; models were run for each fixed effect separately and also in a joint model. In a sensitivity analysis we included an additional 34 black twins in the joint model with an additional fixed effect, but the results of those models were less stable. Results: Net of twinship and shared address: males used hand soap and body lotion less, elders used shampoo and hand soap less, more educated participants used laundry detergent and cleaners less, and more floor or furniture polish use was associated with ever being bothered by fragrances. In the white-only joint model, elders used hand soap and kitchen/bathroom cleaners less, but other relationships were similar to unadjusted models. In the joint model including black participants, black race was associated with less use of shampoo and greater use of body lotion. The racial differences in shampoo use and gender differences in body lotion were most significant ($p < 0.0001$). Conclusions: Reported use of fragranced products differs demographically across products.

Abstract Number	**P-2-31-03**
Presenter	Jaana Halonen*, Jussi Vahtera, Mika Kivimäki, Jaana Pentti, Ichiro Kawachi, Kuyilan Karai Subramanian
Exposure	others
Health domains	physical activity
Type of research	cross-sectional study

Does socioeconomic adversity in childhood explain the association between neighborhood disadvantage and health behaviors?

Background Early life socioeconomic adversities may play a role in the associations observed between neighbourhood characteristics and health. However, few studies have examined whether childhood adversity is a confounder or modifier in the associations between neighbourhood socioeconomic disadvantage and health behaviours. Aims We examined the role of self-reported childhood adversity in the association between neighbourhood disadvantage and co-occurrence of behavioural risk factors (sum of smoking, moderate/heavy alcohol use and physical inactivity) among 31 271 Finnish public sector employees. Methods The analyses were run using multilevel cumulative logistic regression with adjustments first for age, and then also for sex, marital status, individual socioeconomic characteristics (occupational position, residence size and housing tenure), and population density in the area. Results Childhood adversity was associated with co-occurrence of behavioural risk factors with age-adjusted cumulative odds ratio (COR) of 1.32 (95% CI: 1.25-1.40, for 3-6 vs. 0 adversities). However, adversity had no effect on the association between neighbourhood disadvantage and the sum of risk factors; this age-adjusted COR was 1.52 (95% CI: 1.43-1.62) in the highest vs. lowest disadvantage quartile when not including adversity, and 1.50 (95% CI: 1.40-1.60) when adjusting for childhood adversity. Additional adjustments attenuated both associations (COR 1.20, 95% CI: 1.12-1.29 for the highest vs. lowest quartile of disadvantage, and COR 1.25, 95% CI: 1.18-1.33 for 3-6 vs. 0 adversities). In adversity-stratified analyses those reporting 3-6 adversities had higher likelihood of co-occurrence of health risk behaviours than those with 2, 1, or 0 adversities (test for interaction p=0.07). Conclusions Childhood adversity has no effect on the associations between neighbourhood disadvantage and co-occurrence of behavioural risk factors in these data. However, those with more adverse childhood experiences may be susceptible for the socioeconomic effects of neighbourhoods.

Abstract Number	**P-2-31-04**
Presenter	Cyrille Harpet*, Marie Peretti-Ndiaye
Exposure	others
Health domains	equity
Type of research	others

Environmental hazards in low income neighborhoods. An urban anthropological study

Context : Social inequalities affecting health are aggravated by environmental factors. An urban anthropological survey was conducted between 2011 and 2012 in the French cities of Lyon and Lille. Three different cases of cumulative environmental and health hazards among at-risk households are studied. Aims : The goal is to present the types of environmental and health injustices experienced by residents. These forms are the result of cumulative exposure to health damaging factors and the limited capacity to act. These limitations render inhabitants unable to reduce the negative impacts and effects. Exposed to external factors (urban noise, air pollution, industrial and natural risks, electromagnetic waves), their avoidance-reduction-suppression strategies are limited. Method: The survey remapped urban sites at the sub-municipal level (the IRIS, INSEE's statistical units: "îlots de regroupements pour l'information statistique"). One hundred semi-structured interviews were conducted in the homes of residents located in areas that scored high on the deprivation index for social and economic inequalities (Deguen, EHESP, 2010). The questionnaire focuses on the living conditions and perceptions of health risks. Results: The resulting monographs differentiate three types of cumulative social, environmental, and health deprivations: industrial and natural hazards in an industrial area (Lyon), the risk of urban isolation by infrastructures (Lille), deteriorated social housing (Lyon). Conclusions: These situations were modeled based on three criteria for defining forms of injustice. The first is the differences in advantages and disadvantages between social groups (urban noise levels, natural and industrial risks, air pollution). The second is a non-reciprocal distribution of unfavorable factors (compensation processes). The last criterion is the accumulation of charges (the environmental burden) by the affected populations, which amplifies their exposure and vulnerability (Aïach, 2010; Leclerc, 2008).

Abstract Number	**P-2-31-05**
Presenter	Miranda Jones*, Ana Navas-Acien, Ana V. Diez-Roux, Anjum Hajat, Kiarri N. Kershaw, Marie S O´ Neill, Eliseo Guallar, Wendy S. Post, Joel Kaufman
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cross-sectional study

Ethnic Differences in Exposure to Ambient Air Pollution: the Multi-Ethnic Study of Atherosclerosis (MESA)

Background: Race/ethnicity is highly correlated with residential location in the US, with Whites and minorities often living segregated from one another. Differential residential location can result in important differences in environmental exposures such as air pollution. Aim: To assess associations of ambient air pollution exposure with race/ethnicity and racial residential segregation. Methods: We studied 5,677 White, Chinese, Black and Hispanic adults who participated in the Multi-Ethnic Study of Atherosclerosis across 6 US cities. Ambient air pollution was assessed using concentrations of fine particulate matter (PM2.5) and oxides of nitrogen (NOX) for the year 2000 at home addresses. Neighborhood racial composition (% of each race/ethnicity) and residential segregation (G statistic) were estimated using census tract data from the 2000 US Census. Results: After adjustment for sociodemographics, Chinese, Black and Hispanic race/ethnicity were associated with 29%, 7% and 6% higher PM2.5 concentrations, respectively, and 58%, 27% and 54% higher NOX concentrations, respectively, compared to White participants, with significant heterogeneity across cities. Participants in neighborhoods with >50% Asian or Hispanic populations were exposed to 6% and 2% higher PM2.5 concentrations and 3% and 16% higher NOX concentrations compared to those in neighborhoods with <25% of the population identifying as Asian or Hispanic. Participants in neighborhoods with an over-representation of Hispanics were exposed to higher NOX concentrations. Conclusions: Chinese, Black and Hispanic race/ethnicity, living in majority Asian or Hispanic neighborhoods and living in segregated Hispanic neighborhoods were associated with higher air pollution exposures. These findings provide novel information regarding ethnic differences in environmental exposures and highlight the importance of measuring neighborhood level segregation in the environmental justice literature.

Abstract Number	**P-2-31-06**
Presenter	Tee L. Guidotti*
Exposure	ambient air pollution
Health domains	equity
Type of research	cohort study

Health of Cattle and Wildlife Downwind from Gas Facilities: The Western Canada Study

Conflict over land use between natural gas development and cattle ranching became acute in western Canada until in 2000 the Western Canada Study was organized to investigate allegations of health effects. There were two important goals: 1) to determine if emissions downwind from oil and gas facilities influence the reproduction and health of cattle and wildlife in western Canada and 2) to provide new and economically useful information for cow-calf producers on factors affecting herd productivity and herd health. An arm's-length management agency was set up to support and oversee the study, with multiple stakeholders involved. The principal investigator for the Study was Dr. Cheryl Waldner, veterinary epidemiologist at the University of Saskatchewan. The author chaired the Scientific Advisory Pane, which took an active role in study design and provided oversight. An arm of the Study devoted to human health was terminated before it began, ostensibly as a budgetary recission but probably for political reasons.A tandem wildlife study was implemented using European starlings as an indicator species. The overall pattern of findings demonstrated no adverse effect of downwind exposure on animal health, although the Study found some associations that suggested possible effects at levels of SO2 much lower than expected . Air quality in field locations compared favorably with other rural and with urban centers. Important design features of this Study included the innovative management structure, a secondary goal of improving herd management, a hypothesis-driven study protocol, and the unusually active role of science advisors. Emphasis in this presentation is on the study design, exposure assessment methodology and project management. The innovations and practices of this Study, and in particular the management organization of WISSA, could be a useful model for conducting studies in the context of similarly contentious issues, such as "tight" (shale) oil and gas recovery using fracking.

Abstract Number	**P-2-31-07**
Presenter	Jessie Carr*, Jennifer Bobb, Jane Clougherty, Thomas Matte, David Savitz
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	exposure measurement

Influence of spatial heterogeneity in socioeconomic deprivation on birth outcomes and air pollution epidemiology in New York City, USA

Background: Numerous studies have linked area-level socioeconomic deprivation with adverse birth outcomes. Deprivation is often operationalized as a composite index, which efficiently combines diverse components of socioeconomic position (SEP), but also may obscure spatial heterogeneity in variable distributions, potentially biasing epidemiological models. Aims: We aimed to build (and test) a deprivation index reflecting spatial heterogeneity in New York City (NYC), to include with fine-scale air pollution in birth outcomes models. Methods: We explored intra-urban spatial variability across contextual SEP factors previously associated with birth outcomes (n=20). We applied spatially-stratified Principle Components Analysis (borough-level) to reflect spatially-varying prevalence and combinations of SEP factors in a composite deprivation score. For comparison, we calculated a crude citywide index following the same data reduction process. Results: The spatial deprivation index retained seven area-based SEP variables (college degree, unemployment, management/professional occupation, residential crowding, poverty, households receiving public assistance, non-white racial composition), explaining 55% of overall variance in SEP factors. The crude index included fewer and somewhat different SEP variables, explaining 41% of overall variance, and correlated with the spatial index at r=0.70. Residential outdoor PM2.5 exposure was differentially correlated with the spatial (r=-0.11) and crude (r=0.02) indices. After adjusting for individual covariates and exposure to PM2.5, spatial and crude deprivation indices were associated with 5.32g and 6.56g decrements in birth weight per IQR change in SEP index – small changes, yet within the range of concern for air pollution effects on birth outcomes. Conclusions: Spatially-informed data reduction techniques can improve estimation of area-level deprivation, and elucidate potential confounding and bias in epidemiological analyses.

Abstract Number	**P-2-31-08**
Presenter	Lopamudra Paul*
Exposure	others
Health domains	healthrelated quality of life
Type of research	health impact assessment

Is rapid urbanization in India happened at the cost of health of urban poor?

Aims: To examine the health and causes prevailing diseases among urban poor in India, the paper is emphasizing the environmental condition in slums and its effect on people living there vis a vis in swanky areas. Methods: The paper analyse data from 56961women & 38199 men living in 50236 household in urban areas in India from the National Family Health Survey-1, 2 & 3. Apart from their socio-demographic status, wealth index were considered to estimate impact on their health status. Incidences of diseases like diarrhoea, ARI among children and prevalence of TB among adults were examined for health status. Types of water supply, cooking fuel used and No. of rooms at house vis a vis household size (for crowding) were also analyzed through multivariate analysis. Results: The results show that people with lower wealth index are using firewood for cooking and not using piped water in urban areas. Incidence of water and air borne diseases are high at overcrowded households in urban dwellings. People do not have access to safe drinking water or flush toilet facilities and the situation did not improve over time. Affordability is low among urban poor which causes low treatment adherence. Conclusions: As the urbanization perceived as an indicator for development but planned cities may help to improve health of urban poor in future. Availability of safe drinking water and satiation along with knowledge on WASH may save lives of many poor living in slums in swanky cities.

Abstract Number	**P-2-31-09**
Presenter	Brenda Gasparini*, Suzana Aguiar
Exposure	others
Health domains	cancer
Type of research	time series study

Mortality from male laryngeal cancer in the Southeastern Brazilian

Background: The larynx is one of the most common site of occurrence of neoplams in the head and neck. In Brazil, laryngeal cancer was responsible for 3,6% of deaths from cancer in men and 0,6% in women between 2005 and 2009. Many environmental factors and lifestyle-related are associated with its development. Tabacco and alcohol consumption are the most established risk factors for this disease. However, occupational exposure to carcinogens are also associated. Aims: To analyze the mortality trends of male laryngeal cancer in the Southeastern Brazilian geographic regions between 1980 and 2010. Methods: A descriptive study was realized using data on male laryngeal cancer deaths registered in the Mortality Data System (SIM/WHO) and population data were provided by Brazilian Institute of Geography and Statistics (IBGE). Age-standardized and specific mortality rates were calculated. Linear regression and Estimated Annual Percentage Changes (EAPC) were used to investigate changes in trends for the each State of Southeastern Brazilian. Results: Laryngeal cancer deaths were more common in men after the fifty decade of life. Considering the states of Brazilian Southeastern, the annual age-standardized mortality rate increased in Espírito Santo and Minas Gerais (EAPC=1,31% and 0,60%, respectively), between 1980 and 2010. However, decreases were found in Rio de Janeiro (EAPC=-1,09%) and São Paulo (EAPC=-0,70%). Conclusions: The Brazilian states of southeastern showed different trends in male mortality from laryngeal cancer. These findingsimplythe importance to improve tabacco control measures and excessive alcohol consumption, as well as monitoringof occupational exposure. Furthermore, measures for diagnosis and early treatment may impact on mortality by this disease.

Abstract Number	**P-2-31-10**
Presenter	Federico Fabbri*, Rebecca Ghosh, Lea Fortunato, Daniela Fecht, Linda Beale, Anna Hansell
Exposure	others
Health domains	other
Type of research	others

ONLINE ENVIRONMENTAL EPIDEMIOLOGY, A PLATFORM FOR THE ENVIRONMENTAL HEALTH ATLAS FOR ENGLAND AND WALES

Background. The advent of online mapping occurred in the last decade has shaped the way information is delivered to Web users. On-line maps are available to and accessible by a broadaudience and must therefore be simple and easy to use. In the late nineties some attempts to develop small web GIS were made but never reached the level of usage worth the effort and resources in their development. Things however changed when large affirmed companies (e.g. Google) entered the geospatial market. The next generation of on-line mapping was dictated by the need of a more interactive experience. The emergence of maps which provide added data upon user request (via mean of clicks, hovering etc) have characterized the latesttrends.., Aim. To make use of web technologies to provide a platform to display maps and interpretive information developed for the Environment and Health Atlas for England and Wales to communicate findings about geographical variations in risk to members of the public ,public health practitioners and policy makers. Methods. The application allows the investigation of 17 thematic maps. It is fully open source and integrates several third party software (libraries) including the excellent LeafletJS , which single handedly is transforming the way mobile and web Maps are developed. The application is currently in beta format and is being developed in consultation with ‘Sense About Science’, an English NGO aiming to improve the public understanding of science. Key issues have ranged from the technical e.g(how to represent complex vector data),to visual presentatione.g(most appropriate colour ramp and methods to represent uncertainty). Conclusion. Simplifying complex statistics and visually structuring information are key to a meaningful engagement with both the general public and more specialist information. The on-line Atlas is designed to be consulted widely,which has involved extensive preparatory work.

Abstract Number	**P-2-31-11**
Presenter	Kristoffer Mattisson*, Carita Håkansson, Emilie Stroh, Kristina Jakobsson
Exposure	others
Health domains	other
Type of research	cross-sectional study

Relationship between commuting and social capital in a cross-sectional population survey in southern Sweden

Background: Commuting, transportation from the home to the work place has been claimed to increase the material wealth. Although economy and flexibility to choose where to live and work will improve for the individual, several studies have shown that health become aggravated with increased commuting. One plausible explanation to the negative health is reduced social capital. Aim: Our primary hypothesis is that the longer the commuting time the less time for social participation and thereby a lower social capital. Methods: The study design is cross-sectional and the study material consists of two retrospective data sets collected through questionnaires in 2004 and 2008 (N=21,088 persons; response rate 56 %). Commuting was defined as transportation from the home to the work place, and characterized by duration one way (<30 min, 30-60 min, >1 h) and mode (active, car, public). Active commuting <30 min was used as reference category and included all those only walking or cycling. Based on a measure in a former article, social capital was defined as a combination of questions on social participation and generalized trust to other people. Relationships between social capital and the exposure variable will be investigated with log-binomial regression. Results: Has not yet been produced but a primary analysis done with logistic regression (as an indicator, instead of log-binomial regression) seems to shows an association between social participation and increasing commuting time both with car and public, compared to active commuting. Low generalized trust seemed not to be strongly associated with commuting. These resultscould be expected as time spent on commuting should be a influencing factor for social participation, while generalized trust probably are more influenced by other factors. Results will be available to be included in the presentation on Environment and Health - Bridging South, North, East and West 2013.

Abstract Number	**P-2-31-12**
Presenter	Hyun-joo Bae*, Yura Lim, Seung-Do Yu, Jeong-Hwa Kim, Yong-Sung Cho
Exposure	ambient air pollution
Health domains	equity
Type of research	time series study

TEMPERATURE MODIFIES ACUTE EFFECTS OF PM10 ON TOTAL MORTALITY ACCORDING TO SOCIOECONOMIC STATUS

Background and Aims: Many studies have indicated that ambient particulate matter and temperature have been associated with daily mortality. However, the modifying effect of the temperature on the air pollution-mortality relationship has been scarcely reported. The present study investigated whether temperature modified the PM10 effects on total mortality, and whether the effect modification varied with socioeconomic status(SES). Methods This study used a Poisson regression model to explore weather temperature modified the association between PM10 and mortality from 1999 to 2010 in Seoul, Korea. In order to examine patterns of interaction of both PM10 and temperature on mortality, we fitted a response surface model controlling the time-trends and meteorological variables. The effects of PM10 were stratified by temperature stratum to examine the interaction effect of PM10 and mortality. Results A 10$\mu g/m^3$ increment in PM10 was associated with an increase of 0.44%(95% confidence interval [CI]: 0.06~0.81%), 1.35% (95% CI: 0.65~2.06%), and 0.31% (95% CI: -0.07~0.68%) in mortality at all, low (below the threshold temperature) and high (above the threshold temperature) temperature levels relatively. We examined whether SES, as marked by education, measure at individual level, modified the association of PM10-temperature with mortality. When the temperature was high, for a 10$\mu g/m^3$ increment in PM10 was associated with an increase of 2.29%(95% CI: 0.63~3.97%), 1.76%(95% CI: 0.85~2.69%), 0.88% (95% CI: -0.21~1.99%) in mortality for the low, middle, and high individual SES group, respectively. Conclusions The results imply that it is important to consider the modifying effect of the temperature when estimating PM10 related health impact. In addition, the PM10 effects on high temperature level days were stronger on low SES group compared with other groups. We recommend that public health policies to minimize adverse health impact of high temperature and PM10 will become important for preventing deaths, especially among the low SES.

Abstract Number	**P-2-31-13**
Presenter	Anjum Hajat*, Ana V. Diez-Roux, Sara Adar, Amy Auchincloss, Gina Lovasi, Marie S. O'Neill, Lianne Sheppard, Joel Kaufman
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cross-sectional study

The burden of air pollution on poor individuals and neighborhoods: Evidence from the Multi-Ethnic Study of Atherosclerosis (MESA)

Background: Much research has documented that low socioeconomic status (SES) and minority communities have higher exposures to air pollution. Few studies have simultaneously investigated the associations of individual and neighborhood SES (NSES) with pollutants across multiple sites. Aims: To characterize the distribution of ambient air pollution by both individual and neighborhood SES using appropriate spatial regression methods. Methods: The study population was 6136 individuals living in six metropolitan areas from the Multi-Ethnic Study of Atherosclerosis (MESA). Year 2000 annual average ambient PM2.5 and NOx concentrations were calculated for each study participant corresponding to their home address at baseline examination. Several individual and NSES measures (neighborhood defined as census tracts) corresponding to the domains of income, wealth, education and occupation were investigated. A spatial intrinsic conditional autoregressive model was used for multivariable analysis. Pooled and metropolitan area specific models were run. Models were adjusted for participant age, race, sex, metropolitan area, population density and high density land use. Results: One standard deviation unit increase in the neighborhood's percentage of persons with at least a high school degree was associated with 0.26 µg/m3 lower mean PM2.5 (95% confidence interval (CI): -0.31, -0.22) and 8.39% lower NOx (CI: -9.63, -7.15). Individual SES was not associated with air pollution after adjustment for covariates. Metropolitan area specific models were similar to pooled results, except in Chicago and New York where high SES individuals and neighborhoods had higher levels of pollution exposure relative to those with lower SES. Conclusions: We found a small but statistically significant association between neighborhood, but not individual, SES and predicted air pollutant concentrations, demonstrating the importance of accounting for NSES in air pollution health effects research.

Abstract Number	**P-2-31-14**
Presenter	Rebecca Ghosh*, Lea Fortunato, Federico Fabbri, Ellen McRobie, Helga Laszlo, Daniela Fecht, Oliver Robinson, Linda Beale, Lars Järup, Paul Elliott, Anna Hansell
Exposure	others
Health domains	other
Type of research	others

THE ENVIRONMENT AND HEALTH ATLAS FOR ENGLAND AND WALES

Background The Small Area Health Statistics Unit is nearing completion of an Environment and Health Atlas for England and Wales. The Atlas provides a high quality, comprehensive, collection of over 120 maps of contextual information, common environmental hazards and diseases of public health importance at a local level. Aim The aim is to provide information on geographic patterns of disease and selected environmental hazards to help with the development of hypotheses and research into health risks that may relate to environmental exposures. Method The Atlas is divided into two sections, (i) patterns of spatial distribution for six selected environmental hazards across England and Wales and (ii) fourteen selected health outcomes at ward level in England and Wales (1985-2009). Interpretations are provided based on a review of the evidence in relation to major risk factors and major environmental risk factors, with particular reference to international and governmental advisory bodies (e.g. WHO, IARC), systematic reviews and key studies in the field. These include geographical variation, risk factors and time trends. All chapters have undergone peer review. Communicating findings appropriately is important. We have identified four potential audiences for the atlas: academics in environmental health, experts in other fields (e.g. clinicians), policy makers and the public. We have been working with Sense About Science, a charity whose aim is to promote public understanding of science, to help develop appropriate formats and levels of information for each of these audiences. This has involved both meetings, lay panel reviews and piloting of the interactive version of the Atlas. Conclusion The Atlas provides readers with maps of spatial variations over the last 25 years for fourteen health outcomes and six environmental hazards across England and Wales. The two different formats (print and online interactive) provide a unique opportunity to engage with a wide range of audiences.

Abstract Number	**P-2-31-15**
Presenter	Mark Miller*, Patricia A. Buffler, Todd P. Whitehead, Ruwani Ekanayake, Brenda Giddings, Giovanna Cruz
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	others

Trends in Childhood Leukemia and Household Chemical Exposures by Ethnicity in California

Background: Childhood leukemia rates have increased from 1975 to 2009 in the U.S. at an estimated average annual percent change of 0.7%. Incidence rates differ by race/ethnicity with Hispanic children exhibiting higher rates than other groups. Differences in incidence rates may reflect genetic susceptibility as well as patterns of exposure between populations and indicate potential areas for investigation. Given their structural similarity to PCBs, another class of chemicals associated with childhood leukemia risk, PBDEs are candidate environmental risk factors for childhood leukemia. Aim: To examine trends in incidence in California by race/ethnicity for childhood leukemia and contrast these trends with levels of contaminants in household dust samples. Methods: We examined trends in childhood leukemia by ethnicity in California from 1998 through 2009 using data from the California Cancer Registry and contrast these with levels of PBDEs in house dust. Results: The incidence of leukemia among California children aged 0-14 has been increasing about 1% per year between 1999 and 2009 and this increase is highest in Hispanic children. During this time interval, leukemia incidence in white non-Hispanic children has not shown a statistically significant increase, but leukemia rates have increased approximately 1.5% and 3.1% per year among Hispanic and Black children, respectively. Concentrations of specific PBDEs (i.e., BDE-47 and BDE-99) in household dust were 50% higher in homes of Hispanic families than in non-Hispanic White or Asian families. Conclusions: Incidence of leukemia is highest in Hispanic children in California and is increasing relative to white children. Though during these years, increases in ALL incidence were noted also in Black children, their incidence rates were lowest. It will be important to systematically identify all environmental stressors, like PBDEs, to which Hispanic populations are disproportionately exposed.

Abstract Number	**P-2-31-16**
Presenter	Brenda Gasparini*, Gina Torres Monteiro
Exposure	others
Health domains	cancer
Type of research	time series study

Trends in mortality from tumors of the central nervous system in adults, Rio de Janeiro, 1980-2010

Background: Tumors of the Central Nervous System (CNS) are relatively rare in adults, but they present a high mortality rate: only half of the cases survive one year after diagnosis. Aims: To describe the mortality pattern from CNS tumors in adults in the city of Rio de Janeiro, Brazil, from 1980 to 2010. Methods: We conducted a descriptive study of deaths through the Consolidated Information System on Mortality. We calculated crude and adjusted mortality rates, as well as gender, age and tumor-specific mortality rates. For trend analysis, regression models were performed and the EAPC (Estimated Annual Percentage Change) was calculated. Results: In 1980, the mortality ratewas4.97/100,000 person-years, while in 2010the ratereached7.91/100,000 person-years. During the study period, most deaths were observed in white men, and occurred due to malignant tumors located in the encephalon. The standardized mortality rate for CNS tumors in adults over age 19 years increased 1% annually throughout the period. This increase was greater in women: 1.7% per year. Conclusions: The patterns of mortality from CNS tumors in the municipality of Rio de Janeiro are in accordance with global trends. Therefore, it is recommended to develop analytical studies to identify risk factors associated with these tumors, which may include genetic and environmental factors.

Abstract Number	**P-2-31-17**
Presenter	Chung-Yi Li*, Wei-Ling Chen, Pei-Chun Chen
Exposure	others
Health domains	other
Type of research	cohort study

Urbanization level of residential area poses a greater effect than parental education on risk of mortality in children

Background: It is well documented that both parental education and urbanization of residential area may affect children's health. It is not clear, however, which one posed a greater effect. Aims: To determine and compare the effect of urbanization of residential area and parental education level, respectively, on risk of mortality in Taiwanese children aged 5 or less. Methods: The study cohort was consisted of all 1,486,649 live births registered between 1996 and 2000 in Taiwan. The study cohort was classified into four groups according to their parent's education and the urbanization level of their residential areas, which was characterized by a summary index taking into account the socio-demographic, economic, agriculture, communication, and healthcare system characteristics. The four study groups were linked to the death certificates searching for the study subjects who died at age of 5 or less (n=11,094). Multivariate logistic regression model was employed to estimate the adjusted odds ratio (aOR) of mortality among children in each group. Results: Compared to the children of higher parent's education and higher urbanization level, the other three groups were all at significantly elevated aOR of neonatal (<28 day) mortality, with the most increased figure noted for children with lower parent's education and lower urbanization level (aOR=1.60). The aOR was slightly greater for children with higher parent's education but lower urbanization level than for those with lower parent's education but higher urbanization level (aOR: 1.31 vs 1.23, p<0.05). Similar findings were observed for both infant (<1 year) mortality and under 5-year mortality. Conclusions: Urbanization level of residential area posed a greater effect than parent's educational attainment on risk of mortality in children less than 5 years, highlighting the importance of geographic and environmental factors on children's health.

Abstract Number	**P-2-31-18**
Presenter	Peter Aitken, Shilu Tong*
Exposure	no exposure
Health domains	policy
Type of research	review

The impact of psycho-social factors on the effectiveness of heat warning systems

Background Health behavior/promotion theories and studies confirm that the effectiveness of health messages in changing behaviors greatly relies on socio-demographic, cognitive and emotive factors. Many countries have implemented heat warning systems (HWS) to minimize health risks, particularly among vulnerable groups. Studies suggest that these systems reduce mortality; however their effectiveness and impact on changing people's behavior against heat harm is unclear. Aims To review the literature on psychosocial factors that can hamper or improve the effectiveness of HWS in saving lives and reducing harm. Methods A systematic search of major databases was conducted with keywords "heat, heatwave, high temperature, hot temperature, OR hot climate" AND "warning OR alert system". Results Only eight relevant studies were found- USA (3), Canada (2), UK (2), Australia (1). All were retrospective and, except two, lacked a theoretical model to guide the research. Ethnic minorities were mostly excluded. The findings suggested that participants were overall cognisant of heat warnings through various media. However, they did not necessarily act on these messages.They were more likely to take actions (e.g. light dress, hydration, cooling) to protect themselves or others against heat dangers if they perceived it to be a threat (emotive factor). Issues such as costs of running air-conditioners or accessing cooling shelters were reported to act as barriers particularly to the poor exposing them to heat harms. Conclusions Warning messages may reach people, but are not always translated into action because of attitudinal, socio-demographic and cost factors. Attention to these should improve HWS' effectiveness. Research in this area is very limited. Prospective studies applying health behavior/promotion theories should identify vulnerable groups (e.g. homeless, people with language difficulties, elderly) and investigate the specific ways in which HWS can produce the health benefits they are purported to achieve among these groups.

Abstract Number	**P-2-32-01**
Presenter	David F Goldsmith*
Exposure	others
Health domains	respiratory disease
Type of research	health impact assessment

Why is there No New Silica Dust Standard in the U.S.?

Background: There has been a proposal for a new silica dust standard (SDS) under consideration in the U.S. Office of Management and Budget (OMB) since 2011. This assessment examines the evidence over the past 2 decades and attempts to provide an explanation. Current rule: In the U.S. the current standard is workers are not to be exposed to >0.1 mg/m3 of pure quartz dust over a 8-10 hour work shift. The current rule was put in place to prevent silicosis in 1971, when the U.S. Occupational Safety & Health Administration (OSHA) adopted rules used by American Conference of Governmental Industrial Hygienists (ACGIH). Current evidence: Since 1997 IARC has defined workplace respirable crystalline silica as a known human carcinogen, with research showing pulmonary tumors in both workers and in laboratory animals. Furthermore, recent epidemiology evidence has shown that silica exposure is very likely to cause auto-immune diseases including rheumatoid arthritis, scleroderma, and chronic kidney diseases. Additionally extensive research has shown that the current SDS is inadequate to protect workers with lifetime exposure to respirable silica from contracting both silicosis and lung cancer. Synthesis: There is no "official" reason that OMB has not permitted a new SDS to be released. There appears to be concerns about costs to industry as well as technological capabilities to measure lower dust levels. The lack of a new SDS also hurts international efforts to reduce silica dust levels and thus reduce the health toll on quartz-exposed workers in less developed countries.

Abstract Number	**P-2-34-01**
Presenter	Enkhjargal Gombojav*, Nandinerdene Bayart, Jan Gerd Kuihlieng
Exposure	waste
Health domains	infectious diseases
Type of research	cross-sectional study

Assessment of Waste generation in Ulaanbaatar, Mongolia

Assessment of Health Care Waste generation rate in Ulaanbaatar 1Enkhjargal G, 1Nandinerdene B, 2Jan-Gerd K 1Depertment of Environmental Health Sciences, School of Public Health, HSUM 2ETLog Health, Consulting LTD, Germany Background. Healthcare activities protect and restore health. At the same time they generate large quantities of wastes that need to be managed safely and disposed properly. Aim : We aimed to assess the medical waste generation rates, the available reports on medical waste picked up by the medical waste disposal company from healthcare facilities in UB were collected and evaluated. Results: The result of collected data analysis showed that in average 48,66 ton of medical waste was collected and treated by the company per month. The waste generation rate is not linear but is fluctuating between 40 and 60 tons per month, with a higher generation rate during the second part of the year. The majority of about 45% of the total medial waste stream is generated by the tertiary level hospitals managed by the MoH and in average 30% is generated by secondary level hospitals under the control of City Health Department. Primary level healthcare facilities (>100 in UB City) produce only about 3% of the total medical waste and the rest of 22% of medical waste is generated by the nearly 900 private healthcare facilities. The analysis of the collected data showed a total medical waste generation of about 50 tons per month in Ulaanbaatar. Conclusion: While ¾ of the waste is produced by governmental owned hospitals, about ¼ is generated by private healthcare facilities, for the future it can be expected that the share of the waste from private healthcare facilities will increase. The average waste generation rate in a typical secondary or tertiary level general hospital was about 0,25 kg per occupied bed and day. Primary level healthcare facilities produce about 20-40 kg medical waste per month, the share within the total medical waste is minor with about 3-8%.

Abstract Number	**P-2-34-02**
Presenter	Xia Huo*, Jian Zhang, Xijin Xu
Exposure	waste
Health domains	other
Type of research	health impact assessment

Decreased titers of HBsAb linked to e-waste lead exposure in preschool children

Background: E-waste is becoming the most important waste in the world. Among various recovery techniques, informal processing of e-waste in developing countries has caused serious environment and health problems. Guiyu in southern China is one of the biggest destinations of e-waste in the world and has 30 years of manual recycling history. From nine years ago, we begun to describe Pb, Cd, Cr,Ni, PBDEs, PAHs, PCB PFOA in local neonates and children were significantly higher than those of control areas. Aims: In this study, we investigate how heavy metals, especially lead exposure in this e-waste areas impacts on the levels of antibodies against human hepatitis B surface antigen (HBsAbs) expression, as well as lymphocyte subsets in hepatitis B-immunized children. Methods: Children from e-waste recycling town, Guiyu and non-recycling control town were enrolled. HbsAb, lymphocyte subsets and white blood cells (WBC) were measured in local hospitals. Heavy metals were measured by GFAAS. Results:Higher blood lead, Cadmium and Chromium levels, WBC, B cell percentage and counts, but lower HBsAb titers, NK cell percentages and counts appeared in the exposed children compared to controls ($P<0.05$). Generalized Linear Model regression showed negative correlations between HBsAb concentrations and blood lead levels (BLLs), Th (CD4+) cell percentage, and positive correlations with B cell percentage and counts, and NK cell percentage and counts. Generalized Additive Model showed that HBsAb concentrations began to decline dramatically when BLLs reached 15.2 µg/dL in exposed group and 10.9µg/dL in control group. Conclusion: Exposure to e-waste recycling in the community is related to higher blood lead, Cadmium and Chromium exposure and decrease HBsAb titers, NK cell percentages and counts in local children.

Abstract Number	**P-2-34-03**
Presenter	Tafe Veselaj, Mimoza Hyseni-Spahiu Hyseni-Spahiu, Afrim Berisha, Perparim Gashi, Rifat Morina*, Ilir Morina, Cornel Florea – Gabrian Florea – Gabrian
Exposure	waste
Health domains	other
Type of research	review

Environmental threatened places - hotspots in Kosovo

Background-Ecological problems in Kosovo have accumulated over decades as a consequence of the uncontrolled use of natural and mineral resources, a growing industrial production with a high level of pollution, and a lack of appropriate policies, laws, and institutions which could treat and solve the problems. As a result, the environment in Kosovo has been degraded, and severe negative impacts on the health of the population have already occurred. However, the public's knowledge in Kosovo about environmental issues has been found to be very limited. Industrial development that does not comply with environmental standards is the main source of pollution. Aim-The aim of this project were to identify potential environmental hot-spots in Kosovo, to provide basic information about their condition, and to provide information which could be used to initiate projects for developing more detailed studies. Methods -Methods that were used for this research to identify hotspots are; Further selection according to their contamination origin destination, Size determination, Measurements through GPS, their appearance through orthographic photos and, environmental impact assessment on human health Results-There are 6 municipal and regional landfills in the territory of Kosovo, which are considered as potential hotspots, and which are located in: Prizren, Podujevë Obiliq, Mitrovicë, Gjilan and Peja.Most of the places that are identified as hotspots from hazardous chemicals are in the region of Peja Radioactive substances are concentrated in two industrial cities, Mitrovica and Hani i Elezit, but more than half of them are in Hani i Elezit city as a result of ex-factory for asbestos-cement production. Conclusion -During the fieldwork in the entire territory of Kosovo, about 110 sensitive spots are evidenced, whereas, 28 areas with the potential for greater impact on the environment and threat to public health have been identified and presented.

Abstract Number	**P-2-34-04**
Presenter	Marjaleena Aatamila*, Anna Liisa Suominen, Maarit Jaana Korhonen, Aino Nevalainen, Pekka Tiittanen, Marja Viluksela, Pia K Verkasalo
Exposure	waste
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Environmental worry and families with children in residential areas near waste treatment centres

Background It has previously been shown that waste treatment centres may produce odour emissions and subsequently cause discomfort in nearby residential areas. Moreover, we have previously found in our data, that the vicinity of waste treatment centre was associated with elevated environmental worry among respondents living near the centre. In addition, we assumed that the worry might differ between respondents with and without children in their household. Aims The aim was to study if families with children suffer environmental worry more than those without children in areas near waste treatment centres. This hypothesis was selected because odour annoyance by livestock odours in non-urban areas has been reported being more likely among residents living in households with <18 years old children. Methods Residents living within 5 km from five Finnish waste treatment centres with composting plants were randomly sampled. They (n=1142) were interviewed by telephone and asked about respondent's personal characteristics, and perceptions about health and environment. Environmental worry was defined by asking: "Are you worried of possible environmental problems at your home community?" Results Of all, 26% reported environmental worry: 24% of the respondents from families with children and 28% of the respondents without children. Against the hypothesis, families with children were less worried about the environment (Crude OR 0.8, 95% Confidence Interval 0.6-1.1). This result, although statistically non-significant, remained even after adjustment for age, sex, education, socioeconomic factors, smoking and distance of centre. Conclusions The worry about children in family does not mediate the occurrence of environmental worry among residents in residential areas near waste treatment centres. However, living near the centre increases environmental worry, which emphasizes the importance of community planning and developing waste treatment processes.

Abstract Number	**P-2-34-05**
Presenter	Marta Benedetti*, Lucia Fazzo, Carlotta Buzzoni, Pietro Comba, Corrado Magnani, Mario Fusco
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	others

Incidence of soft tissue sarcomas in an area affected by illegal waste dumping sites

Background and Aim: Soft tissue sarcomas (STSs) are a heterogeneous group of rare malignant neoplasms. Increased risk of STSs was observed in some studies of persons living in the proximity of incinerators characterized by emission of dioxins and dioxin-like compounds. The aim of the present study was to estimate the incidence of STSs, defined in morphological terms, by specific age classes (children, adolescents, adults), in an area of Campania Region (Southern Italy) that since the Eighties is extensively affected by the illegal practices of dumping and setting fire to both hazardous and solid urban waste. Methods: The study adopts an ecological design. Cases were subjects with histologically-confirmed primary malignant STS, originating in non-visceral and visceral locations, diagnosed in the years 1997 through 2005, retrieved from the Cancer Registry of the Local Health Authority Naples 3 South. Standardized Incidence Ratios (SIRs) were computed for the STSs and separately for some specific types/subtypes. The rates of the Southern Italy cancer registries pool were used as reference, with the exclusion of the data of the study area Cancer Registry. Results: The study included 153 STSs cases, 76 males and 77 females, aged 0 to 79. In adults, no significant increase in STSs was found other than for gastrointestinal stromal tumours (GISTs) in adult males (SIR=2.20, 95%CI 1.10-3.94). A non-significant increase in incidence of STSs was observed for male children (SIR=2.05, 95% CI 0.82-4.23), Conclusion: In the present study no significant increase in STSs was found other than for GISTs in adult males. In the absence of previous epidemiological studies on STSs in populations resident in close proximity to illegal waste dumping sites, further investigation are needed.

Abstract Number	**P-2-34-06**
Presenter	Maria Alejandra Terrazas Meraz, Irma Rosas Pérez, Margarita Sanchez Arias, Rosario Guevara Santillán, Ernesto Alfaro Moreno, Natividad Sara García Jiménez, Sonia Patricia Romano Riquer, Cristina Siebe, Horacio Riojas Rodríguez*
Exposure	waste
Health domains	other
Type of research	cross-sectional study

Occupational health risk assessment associated to landfill sites in Cuautla, Morelos, México

Background Household waste of 1.6 million people in Morelos, Mexico, accounting almost 1700 ton/day, which are disposed either in an open dump (93%), or in an landfill sites (7%), with the consequently environmental impacts that affect water, soil and air quality. Aims Pilote study to evaluate the potential worker exposure to envioronmental PM10 and relate it to their health status in the Landfill "Perseverance" in Cuautla, Morelos. Methods Samples of airborne particles (PM10) were collected using miniVol sampler with teflón filters, located in the landfill 2 m above ground level. 23 men workers participate in this study; standarized staff obtained anthropometry data, blood pressure and blood samples previously reading and signing the informed consent letter. Blood samples were analyzed for biochemical factors. Results The workers aged from 18 to 39 years old (P50 = 26). Hemoglobin levels were from 9 to 22 g / dL (p50 = 15.8 g / dL) considering this a low hemoglobin value and 11 samples were above the reference value (16 g / dL). Similar values were found among workers with deshidratation. PM10 average 24h concentrations ranged from 11 to 299 ug/m3. The worker exposure is about 12 h/day (6:00 to 18:00 hours). Conclusions The study group, formed by formal and informal Landfill workers, have similarities health status, customs and lifestyles. This study is an important approach to health impact associated to landfill activities.

Abstract Number	**P-2-34-07**
Presenter	Xu Xijin, Taofeek Yekeen, Xia Huo*
Exposure	waste
Health domains	other
Type of research	health impact assessment

Placental IGF-1 and IGFBP-3 expression correlate with PAH and PBDE levels from prenatal exposure to electronic waste

Background: Electronic waste (E-waste) recycling produces organic pollutants which include polycyclic aromatic hydrocarbons (PAHs) and polybrominated diphenyl ethers (PBDEs). Primitive and uncontrolled recycling in Guiyu, China makes the pollutants ubiquitous. Exposure to PBDEs and PAHs may affect fetal growth and development during pregnancy by altering the insulin-like-growth factor (IGF) system. In this study, the association between chronic PBDE and PAH exposure during pregnancy and the expression of IGF-1 and IGFBP-3 was evaluated. Methods: We recruited 154 pregnant women (101 from Guiyu, 53 from a control city) at the obstetric clinic. Umbilical cord blood (UCB) and placenta were carefully collected upon delivery and questionnaires were administered. PBDEs and a total of sixteen PAHs in UCB were analyzed by GC/MS while placental mRNA levels of IGF-1 and IGFBP-3 were determined by real-time PCR. Results: Infant birth length and Apgar scores were lower in Guiyu with significant differences observed only in females. All PAHs (except Fl, Chr, IP, BbF and BP), total sixteen PAHs (∑16-PAHs), total and individual PBDEs concentrations were significantly higher in Guiyu neonates. Higher levels of IGF-1 (median 0.23 vs. 0.19; $P<0.05$) and IGFBP-3 (median 1.91 vs. 0.68; $p<0.001$) were observed in Guiyu and compared with Chaoan. Multiple regression analysis adjusted for sex and gestation age showed that BDE 154 and ∑5ring-PAHs correlate with IGF-1 expression. Conclusion: The results suggest that prenatal exposure to PAHs and PBDEs in Guiyu influenced placental IGF-1 and IGFBP-3 mRNA expression, which may indirectly affect fetal growth and development.

Abstract Number	**P-2-34-08**
Presenter	Nunzia Linzalone*, Fabrizio Minichilli, Michele Santoro, Fabrizio Bianchi
Exposure	waste
Health domains	no health domain
Type of research	health impact assessment

Planning the study design to assess health impacts in areas with potentially polluting plants: drawbacks and specificities in the HIA21 project

Background One of the aims of the EU-funded project “HIA21” is to focus the impacts deriving from the incinerator of waste located in the industrial area of San Zeno, Arezzo (Tuscany). The assessment of effects due to the plant is complicated by the contemporary presence in the area of other industrial plants potentially harmful to the environment and the health. Observational studies to define the health status of the general population and monitoring activities have been carried out in the area over past years. Critical issues such as gathering of data, agreement on methodological choices and limited time available, could be supported by the Health Impact Assessment approach. Aim The aim is to plan an epidemiological study to estimate the effect of the environmental exposure considering the project constrains and timelines. Methods Planning of the study has involved all the relevant parties and experts to discuss on: 1. Revision of epidemiological approaches available; 2. Collection of environmental and health reports in the study area; 3. Inventory of personal, environmental and health data 4. Definition of the most suitable study design. Results A workshop with stakeholders, experts and the project partners have been arranged to agree on the planned study design and on general considerations. The analytical model, the selection of tracer pollutants, the geographical boundaries, the extra workload for manual geo-referencing, the definition of the health outcomes, the stakeholders concern are specific issues under discussion. Conclusions Feedback to participants will be provided in a transparent way by the official project website. An inclusive procedure will be piloted for planning of the model of epidemiological analysis in the HIA21 context.

Abstract Number	**P-2-34-09**
Presenter	Tak-Hyun Kim*, Seung Joo Lim, Sang-hum Lee, Jun-Young Kim, Sun-Kyoung Kim
Exposure	waste
Health domains	other
Type of research	others

Radiation Treatment of Residual Antibiotics in Livestock Wastewater

Antibiotics are widely used to treat or feed additives on the livestock farms, and the excreted metabolites via urine or feces are directly distributed to the environment. Occurring in the environment even in low concentrations, these compounds are a threat to human health and ecosystems. Generally, organic compounds in wastewater can be degraded by advanced oxidation processes (AOPs). Recently, radiation technology has been given more attention to treat these micropollutants and to enhance the biodegradability of wastewaters. In this study, the occurrence of a total of eleven antibiotics in the livestock WWTP in Korea was investigated, and the controls of antibiotics in livestock wastewater were carried out. Antibiotics in livestock wastewater were analyzed using a liquid chromatography/electrospray-mass/mass (LC/ESI/MS/MS). The radiation experiments were carried out using an electron accelerator (1 MeV, 40 kW). As results, among eleven antibiotics, high concentrations of sulfathiazole, sulfamethazine, sulfamonomethazine and tetracycline were detected in the influents. The frequencies of chlortetracycline, oxytetracycline, and disinfectants in the influents were high. High concentrations of Lincomycin, chlortetracycline, and formaldehyde were detected in the effluents. The frequencies of chlortetracycline and formaldehyde in the effluents were still high. Antibiotics in livestock wastewater were removed effectively by electron beam irradiation. The concentrations of sulfadimethoxine, sulfamethoxazole, sulfamonomethaxine, and erythromycin decreased more than 80% with a 10 kGy electron beam dose. In an advanced biological treatment process combined with electron beam pretreatment system, the removal efficiencies of the organics and nutrients (N, P) increased due to the biodegradability enhancement by a radiation pretreatment effect.

Abstract Number	**P-2-34-10**
Presenter	Ronit Nirel*, Nimrod Maimon, Elizabeth Fireman, Sarit Agami, Arnona Eyal, Alon Peretz
Exposure	waste
Health domains	respiratory disease
Type of research	case-control study

Respiratory hospitalizations of children living near a hazardous industrial site adjusted for prevalent dust: A case-control study

Background: The Ramat Hovav Industrial Park (IP), located in southern Israel, hosts 24 chemical and heavy industry facilities as well as the national site for treatment of hazardous waste. Yet, information about its impact on the health of local population has been mostly ecological, focused on Bedouins and did not control for prevalent dust storms. Aims: This case-control study examined whether living near the IP could lead to increased risk of paediatric hospitalisation for respiratory diseases. Methods: Cases (N=3608) comprised children aged 0-14 years who lived within 40 km of the IP and were hospitalised for respiratory illnesses between 2004 and 2009. These were compared to children admitted (N=3058) for non-respiratory conditions. Individual exposures were based on residential proximity (in kilometres, 0-10, 11-20, 21-40) to the Park. The association between hospitalisation and exposure to IP pollution was examined for three age groups (<1, 1-5, 6-14) by logistic regressions controlling for gender, religion (Jewish, Muslim), urbanity, temperature and regional PM10 concentrations. Results: We found evidence for increased risk of respiratory hospitalization with proximity to the IP for infants during the first year of life (OR: 2.41, 95% CI: 1.46-3.97). RegionalPM10 was associated with an overall increased risk (OR: 1.03, 95% CI: 1.01-1.06), based on PM10 IQR (22.9 µg/m3). In models with both residential distance from the IP and PM10, the estimate for residential proximity of infants aged < 1 year was smaller but still significant (OR: 1.99, 95% CI: 1.12-3.55). Conclusions: Residential proximity to a hazardous industrial site may contribute to childhood respiratory admissions, beyond that of prevailing PM10, among infants in their first year of life. Further studies with more direct exposure assessment and additional health and background data are needed to confirm our observations regarding one of the most polluting sites in the country.

Abstract Number	**P-2-34-11**
Presenter	Danielle Ashworth*, Rebecca Ghosh, Paul Elliott, Mireille B Toledano
Exposure	waste
Health domains	reproductive outcomes
Type of research	others

THE INCINERATORS BIOMONITORING STUDY. Study design and methods

Background. To address public concerns about health risks associated with incineratation, the Small Area Health Statistics Unit (SAHSU) have initiated a national epidemiological study investigating the association between modelled exposure to emissions from municipal solid waste incinerators (MSWI) and adverse birth and neonatal outcomes. MSWIs release a number of pollutants; those of particular concern are a group of chemicals known as dioxins. Aim. The Incinerators Biomonitoring Study will investigate the relationship between modelled ambient dioxin exposure and individual level breast milk dioxin exposure in residents living near two MSWIs in England, Marchwood and Stockton-on-Tees. Methods. Dispersion models will be used to identify areas of modelled high and low dioxin exposure from the two selected MSWIs. This study will recruite 100 pregnant women through their maternity units located near the selected MSWIs. Eligible participants are women in their third trimester of their first pregnancy, living in modelled high and low dioxin exposure zones, over 18 years of age. Eligible participants will be invited via a letter to take part in this study. Following consent, women will be asked to complete a study questionnaire (during the third trimester of pregnancy) and to provide a small, 20mL, breast milk sample (between 1-6 weeks after birth). Once the breast milk samples have been collected, they will be sent to the Centers for Disease Control and Prevention, Atlanta, USA for dioxin analysis. Conclusion. This study will enable us to acquire a detailed personal exposure profile to dioxins for approximately 100 pregnant women residing near two MSWI and to determine the relationship between the modelled ambient dioxin exposure and individual level dioxin uptake. Additionally the Incinerators Biomonitoring Study will aid the interpretation of the SAHSU epidemiological study results and enhance this important, high profile, national study.

Abstract Number	**P-2-34-12**
Presenter	Nosiku Munyinda*
Exposure	waste
Health domains	healthrelated quality of life
Type of research	cross-sectional study

WASTE WATER- AN ASSET OR LIABILITY? A Study on the Use of Waste Water for Irrigation in Lusaka's Kaunda Square Compound

With rising population and the poverty levels in Zambia, there is a big demand for fresh water to meet various uses. This pressure on fresh water has resulted in the poor urban population resorting to using waste water for agricultural purposes. It is against this background that this study was undertaken to obtain an understanding of this practice and in comparison with international guidelines set by the World Health Organization and other reputable institutions, ascertain whether this practice is safe for human health. A mixed methods approach was taken combining both qualitative and quantitative data collection tools techniques encompassing literature review, water and vegetable sampling, interviews and field observations. The study revealed that in almost all the criteria given, the practice falls short of the WHO guidelines. In Crop Restriction, it was found that all manner of crops were grown including those that are eaten raw and do not require cooking like cabbage and lettuce. Further, when it came to Wastewater Application Techniques, the farmers revealed that they sprinkled the water which means that they are exposed to harmful chemicals and organisms in the water. This perhaps correlates with their admission of having suffered from a myriad of illnesses in the last 6 months. The vegetables are sold as soon as they are harvested despite the high levels of e-coli and other pathogens present as evidenced by the results from the water and vegetable samples collected from the area. There is occupational exposure as they lack even basic protective clothing. The irrigation technique used also results in increased exposure even to surrounding communities as the water is left to run without any buffer zone or containment. No education or promotion activities are present to sensitize the concerned communities of these inherent dangers. This is backed by the analytical results of the inlet and outlet points of the ponds. Total Dissolved Solids are almost the same at the outlet as in the inlet and similarly with the conductivity.

Abstract Number	**P-3-03-01**
Presenter	Antonella Zanobetti*, Francesca Dominici, Yun Wang, Joel D. Schwartz
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

A National analysis of the short term effect of PM2.5 on hospitalizations and mortality in subjects with diabetes and the neurological impairment

Background: Short-term exposure to ambient air pollution is associated with mortality and morbidity; diabetes, Parkinson's disease, dementia, and Alzheimer's disease are also a growing burden. Aims: to estimate the short-term effects of PM2.5 on 1) hospitalizations for neurological disorders and diabetes, and 2) on mortality in all Medicare deaths and whether the mortality risks associated with PM2.5 among the elderly is modified by neurological disorders or diabetes. Methods: We examined hospitalizations and deaths among all Medicare enrollees from 1999-2010 in 121 US cities. We conducted city-specific case-crossover analyses to estimate the short-term effects of PM2.5 on 1) hospitalizations in subjects for neurological disorders and diabetes; 2) all-cause mortality risks for all Medicare deaths, and effect modification by previous admissions for diabetes and neurological diseases. Results: 1) In the analysis of hospitalizations we found significant effects of PM2.5 on hospitalization rates for diabetes with a 0.53% increase (95% CI: 0.35-0.71) per 10 mg/m3 increase in the 2 days average of PM2.5, for Alzheimer's disease (0.42% increase, 95% CI: 0.11-0.72), for Parkinson's disease (0.79%, 0.34-1.25), and for dementia (0.59%, 0.14-1.04). 2) We found a 0.64% increase (95% CI: 0.42-0.85) in mortality rate for each 10 µg/m3 increase in the 2 days average of PM2.5 among all Medicare deaths. We found increased mortality risk in subjects with previous admissions for diabetes (0.76%, 0.39-1.12), Parkinson's disease (1.15%, 0.09-2.23), dementia (0.94%, 0.01-1.89), Alzheimer's disease (1.04%, 0.36-1.72), and multiple sclerosis (4.01%, -0.03-8.21), but these were not significantly higher than the overall mortality risk. Conclusions: In this multi-city study we found that particles increased the risk of mortality and of hospitalizations in subjects with diabetes and neurological disorders.

Abstract Number	**P-3-03-02**
Presenter	Horacio Riojas Rodríguez*, Carmen Loreto Gómez, Belem Trejo Valdivia, Maite Vallejo, Astrid Schilmann, Isabelle Romieu
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	others

Acute Wood Smoke Exposure and Heart Rate Variability among Rural Mexican Women

Background. Previous studies have shown an association between air pollution and cardiovascular diseases. But little is known about the cardiovascular effects of indoor air pollution due to household use of solid fuels. Aims. In this study, we investigated the association of fine particulate matter (PM2.5) and carbon monoxide (CO) on heart rate variability (HRV) in women using an open fire or an efficient wood stove (Patsari). Methods. Fifty three women of highlands Michoacan in Mexico using firewood for cooking participated in this study. Twenty-four hours ambulatory electrocardiographic recording with simultaneous continuous personal CO concentration monitoring and micro-environmental monitoring of particles PM2.5 in the kitchens were performed without affecting the daily activities of the participating women. Spectral analysis measures of Heart Rate Variability (HRV) were calculated for 30-min segments. The association between HRV and pollutants levels was analysed using linear mixed models. Results. After adjusting for relevant covariates, we found a significant decrease in the high-frequencies (beta = -0.024, 95% CI -0.041, -0.006) and a tendency towards the reduction for the low frequencies (beta = -0.011, 95% CI -0.025, 0.003) for each ppm of carbon monoxide. We found an association with PM2.5 in the same direction but not significant. Conclusions. The results of this study suggest an association between exposure to carbon monoxide and significant alterations in cardiac autonomic function. These results extend our understanding of the adverse health effects of the CO and fine particulate matter presents in the wood smoke.

Abstract Number	**P-3-03-03**
Presenter	ADIL SAID ALI AL-WAHAIBI*, Ariana Zeka
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

AIR POLLUTION AND HEALTH INDICATORS IN A RAPIDLY DEVELOPING INDUSTRIAL PORT IN THE SULTANATE OF OMAN

Background and Aims: Sohar Industrial Port (Sultanate of Oman), started to operate in 2006, containing many industries that may adversely contribute to the air quality and hence to the health status of the residents in its proximity. The study aim is to assess the health effects of air quality of the population living in the residential area around the industrial port. Methods: Health data for the area were obtained between January 1st 2006 and December 31st 2011 from the Ministry of Health, Oman. Exposure to air pollution was defined using a mixture of methods such as, proximity to source, dispersion models and wind roses. Four exposure zones were developed, including High, Intermediate, Sohar city and the Control zones. Crude rates were calculated for respiratory, cardiovascular and allergic diseases in each exposure zone. Rate ratios were calculated comparing each exposure zone to the Control one. Results: Crude rate ratios for respiratory diseases in the High, Intermediate and Sohar city exposure zones compared to the Control zone were 1.91(95% CI:1.87-1.95), 1.18 (95% CI: 1.15-1.21) and 0.18 (95% CI: 0.18-0.19) respectively. For dermatitis, these rates were 2.16 (95% CI: 1.91-2.45), 1.05 (95% CI: 0.91-1.23) and 0.20 (95% CI: 0.1-0.23). In addition, the high exposure zone showed an increasing yearly trend of the incidence rate from 2007 to 2009 in both diseases. No effects were found for cardiovascular diseases. Conclusion: The findings showevidence of adverse health effects in the high and intermediate exposure zones. More rigorous modeling is underway, which will involve other diseases and confounders. Findings of this study will be used to inform industrial and urban planning policies in Oman.

Abstract Number	**P-3-03-05**
Presenter	Claudia Galassi*, Laura Crosetto, Enrica Migliore, Andrea Evangelista, Giovanna Berti, Elisabetta Chellini, Annunziata Faustini, Francesco Forastiere, Ennio Cadum, the Collaborative EPIAIR Group
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Associations between emergency department admissions for respiratory disorders and daily exposure to air pollution: first results of the Italian EPIAIR project

Background A long-term surveillance project (Air pollution and Health:Epidemiological Surveillance and Primary Prevention–EpiAir) has been implemented in Italy in order to evaluate the effects of potential future preventive programs. Aims The aim of this study is to describe the first results obtained in the EPIAIR project using data on admissions to Emergency Departments (ED). Methods The availability of ED electronic databases with a pre-defined level of completeness (e.g. availability of an ICD-code of diagnosis, of at least three years of data) was checked among the Italian areas involved in EPIAIR; three areas have been included in the study (Turin, Florence and Rome). Data of interest have been extracted from ED databases using a standardized algorithm. The associations between short-term exposure to several air pollutants and ED for selected respiratory disorders was performed using time-series analyses. Results In the city of Turin, about 900.000 ED admissions for the selected diagnosis were available for the period 2006-2009, including 12% for respiratory disorders (33% in the age-group 0-14 years), and 34% for symptoms/ill-defined conditions. We estimated a 0.84% (95%CI 0.03–1.66) and a 1.68% (95%CI 0.62-2.76) increase in ED for respiratory disorders for a 10ug/m3 increase in PM2.5 and NO2 respectively (lag 0–5). The same estimates among children aged 0-14 yrs were a 1.23% (95%CI 0.07-2.40) and a 3.10% (95%CI 1.52-4.70) increase for PM2.5 and NO2 (lag 0–5) respectively. Strong associations were observed for asthmatic symptoms (ICD IX: 786.0, 786.05, 786.07, 786.09) among children at lag 0-1, for which a 10 ug/m3 increase in PM2.5 and NO2 indicated, respectively, a 6.8% and a 11.5% increase in ED admissions. Conclusions ED admissions are very sensitive for studying the association between short term exposure to air pollution and acute respiratory effects. Complete results for the three areas included in the study will be presented at the Conference.

Abstract Number	**P-3-03-06**
Presenter	Pavla Vaneckova*, Hilary Bambrick
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Cause-specific hospital admissions on hot days in Sydney, Australia

Cause-specific hospital admissions on hot days in Sydney, Australia. Background Morbidity outcomes for major disease categories on extremely hot days have received increasing research attention, but a investigations at the level of specific disease subcategories have been limited. Methods We analyzed daily hospitalizations for cardiovascular (CVD), respiratory (RD), genitourinary (GU) and mental diseases (MD), diabetes (DIA), dehydration (DEH) and 'the effects of heat and light' (HEAT) in Sydney between 1991 and 2009. We also investigated the sensitivity to heat of subcategories within the major disease groups. Hot days were defined as those with temperatures in the 95th and 99th percentiles within the study period. We applied time-stratified case-crossover analysis to compare the hospitalizations on hot days with those on non-hot days matched by day of the week. We calculated the odds ratios (OR) of admissions between the two types of days, adjusting for other environmental variables (relative humidity, ozone and particulate matter) and non-environmental trends (public and school holidays). Results On hot days, hospital admissions increased for all major disease categories except GU. This increase was not shared homogeneously across all diseases within a major category: within RD, only 'other diseases of the respiratory system'increased significantly, while admissions for asthma decreased. Within MD, hospital admissions increased only for psychoses. Admissions due to some major categories increased one to three days after a hot day (e.g., DIA, RD and CVD) and on two and three consecutive days (e.g., HEAT and RD). Conclusions High ambient temperatures were associated with increased hospitalizations for several major disease categories, with some within-category variation. Future analyses should focus on subgroups within broad disease categories to pinpoint medical conditions most affected by ambient heat.

Abstract Number	**P-3-03-07**
Presenter	Jennifer L. Peel*, Zev Ross, Nick Clements, William Navidi, Jana Milford, Shelly Miller, Michael Hannigan
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Coarse Particulate Matter and Hospital Visits: The Colorado Coarse PM Rural Urban Source and Health Study

Background: Relatively few studies have specifically evaluated the acute health impacts of coarse particulate matter (PM). Coarse particles are capable of penetrating the thoracic region of the lungs when inhaled and are more likely to contain crustal elements such as aluminum, iron, and calcium, but may also contain ions, transition metals, organic, and biological material compared to fine particulate matter. Aims: Our objective was to examine the association of short-term exposure to coarse PM concentrations and hospital visits for cardiovascular and respiratory causes in an urban and a rural area of Northeastern Colorado. Methods: We conducted a three-year (2009-2011) time-series study examining the association of coarse PM mass with emergency department visits and hospital admissions for cardiovascular and respiratory disease in Denver and Greeley, Colorado. The study area was defined as a 20-mile radius around the two city centers. We evaluated the association using generalized additive models adjusting for long term time trends, day of week, holidays, temperature, and humidity. We evaluated distributed lags and single day lags for pollution. Results: Mean daily coarse PM concentrations were approximately 10µg/m3. Coarse PM concentrations were higher on weekdays and generally higher during summer months. Coarse PM concentrations exhibited higher temporal variability than fine PM in the two locations. Preliminary results were largely null with wide confidence intervals. The strongest associations were observed for asthma visits in both locations. Conclusions: Consistent with previous studies, we observed more evidence for impacts of coarse PM on respiratory visits than for cardiovascular visits.

Abstract Number	**P-3-03-08**
Presenter	Frank Rosenthal*, Markku Kuisma, Timo Lanki, Maarit Jaana Korhonen, James Boyd, Jaana Halonen, Juha Pekkanen
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Cold Ambient Temperature and Sudden Cardiac Arrest: Effect of Medical History on Risk Estimates

BACKGROUND AND AIMS We previously demonstrated an association between cold ambient temperature and the risk of sudden cardiac arrest in Helsinki, Finland. The current study aimed to investigate the effect of previous medical history on the observed risks. METHODS Odds Ratios (ORs) of the risk of out-of-hospital cardiac arrests (OHCAs) vs. temperature were determined by a case-crossover study of OHCAs reported to Emergency Medical systems (EMS) in Helsinki, 1998-2006. Temperature, humidity, ozone and fine particulate levels were independent variables. Exposures were expressed as 24-hr averages in the period preceding the OHCA (Lag 0d), the preceding 24-hr periods (Lag 1d, Lag 2d, Lag 3d) and the average of Lag 0d through Lag3d (Lag 0d3d). ORs were expressed per 1 oC decrement in ambient temperature. Cases were subsetted into disease categories based on government-determined eligibility for drug reimbursement in specific disease categories. RESULTS ORs significantly above one ($p < 0.05$) were found for subjects with hypertension (1.04, 95% confidence interval [CI]:1.01, 1.07) diabetes (1.04,CI:1.00, 1.07), subjects with any cardiovascular disease (1.02, CI: 1.00, 1.05) and for all subjects (1.03, CI: 1.02, 1.04). However these ORs were not significantly different from each other, or from subjects not in the specified disease category ($p > 0.05$). The OR for subjects with coronary heart disease was close to one (1.01, CI: 0.98, 1.04). In a subset cases where the OHCA was determined by EMS as due to myocardial infarction, the ORs for subjects with coronary heart disease and diabetes were 0.99, CI: 0.94, 1.04 and 1.11, CI: 1.03, 1.19 respectively. CONCLUSIONS No definitive effect of medical history on the association of OHCA risk with temperature was found. Possible reasons for the apparently lower risk for subjects with previous coronary heart disease are the effects of drug therapy or changes in the subjects' lifestyle following diagnosis of

Abstract Number	**P-3-03-09**
Presenter	Rebecca Klemm*, Ronald Wyzga, Eddie Thomas
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Comparison of the Estimated Effects of Air Pollution on Human Mortality in Three Southern USA Cities

Background: Researchers have investigated and presented results regarding the impact of air pollution on human mortality for over a decade. We have previously presented and compared results on Atlanta, GA and Birmingham, AL. Aims: We recently began investigating the impact of air pollution on human mortality in Dallas, TX. We present results regarding Dallas, TX and graphically compare the results for all three southern cities: Atlanta, GA, Birmingham, AL and Dallas, TX. We discuss the potential impact of measurement frequency and location sites within a geographic area, as well as imputation methods to create daily air pollution series. Methods: PM2.5, SO2, CO, O3, NO3, and SO4 were measured from monitoring sites within the geographic region encompassing Atlanta, GA, Birmingham, AL and Dallas, TX in varying frequencies and converted to daily average measurements along with daily measurements of temperature and dew point temperature. The relative risk (RR) of mortality due various causes of non-accidental deaths was calculated from results of Poisson regression models with daily deaths as the response variable and daily measurements of air pollution, temperature, dew point, and day-of-week as predictor variables. Models with pollutant lags up to 5 days were investigated using imputed daily series. Results: Positive associations were identified primarily in models with lags up to 1 day for most pollutants within the Atlanta, GA region. We identified few strong positive relationships within the Birmingham, AL region and the Dallas, TX region. Conclusion: The relationship between air pollution and mortality differs by geographic area despite similarities in air pollution concentrations and other atmospheric conditions. This may be due to differences in measurement frequency and imputation techniques to create daily measurements. The models with shorter lags tend to imply the strongest relationships between air pollution concentration and mortality.

Abstract Number	**P-3-03-10**
Presenter	Ana Rappold*, James Crooks, Lucas M. Neas
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Concentration Response Curve for Ozone related Mortality at High Concentrations

Background Rising temperatures and decreased global circulation in the upcoming decades are expected to have a detrimental impact on air quality, particularly with respect to ozone. The largest impacts are anticipated to occur in the form of the frequency and duration of summertime regional pollution episodes. These events are likely to induce nonlinear increases in ozone levels. Objective We examine concentration-response curve for ozone related mortality to evaluate the sensitivity of the health burden with respect to high end of ozone distribution. Methods A flexible Bayesian hierarchical model is developed to allow for the nonlinear ozone risk curve with a shape parameter controlling the prior belief about the monotonicity of the risk. We use polynomial spline basis functions and their derivatives to evaluate relative at different quantiles of the ozone distribution. The model was applied to the data from the US National Morbidity, Mortality, and Air Pollution Study for 95 major US urban centers between 1987 and 2000. Results were examined with respect to those obtained under the assumption of linear effect of ozone without positivity constraint (Bell et al, JAMA 2004). Results Under the assumption of linear effect of ozone relative risk is 0.12+-0.03%. Under moderate and strong monotonicity priors we estimate average log relative rate as 0.25+-0.06% and 0.56+-0.04% per 10ppb, respectively, across the interquartile range of maximum hourly Ozone concentrations. Above the 95% percentile of the ozone distribution these estimates double (0.57+-0.09% and 1.2+-0.05%). Conclusion Our preliminary results indicate that concentration-response relationship is not linear across all levels of ozone. Air pollution episodes are likely to impact high end of ozone distribution and thus contribute larger health burden per unit increase of ozone. Disclaimer: This abstract does not necessarily reflect U.S. EPA policy.

Abstract Number	**P-3-03-12**
Presenter	SatByul Estella Kim*, Youn-Hee Lim, Honda Yasushi, Masahiro Hashizume
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Does temperature modify the association between air pollution and mortality? A multicity meta-analysis study

Background/Aims: A number of studies have shown that both temperature and particulate air pollution exposure are associated with increased mortality, but fewer studies have examined the interactive effects between temperature and particulate air pollution on mortality, especially in Asian countries. Methods: We applied stratified time-series models to 13 cities, 6 cities from Japan and 7 cities from Korea, to examine whether the effects of particulate matter less than 10μm in aerodynamic diameter (PM10) on mortality was modified by temperature. The associations between PM10 and mortality were stratified by temperature to examine effect modification. City-specific Poisson regression models of daily non-accidental deaths, incorporating natural spline smoothing functions, were fit with mean apparent temperature, diurnal temperature range, time, barometric pressure, humidity, day of the week, and PM10. Finally a meta-analysis of the country-specific estimates was performed, using maximum likelihood method. Results: Our results confirm that the effects of PM10 on mortality may depend on temperature. On high temperature (>99th percentile) days, death is expected 1.023 (95% CI, 1.003 to 1.043) times higher for Korea significantly, 1.010 (95% CI, 0.997 to 1.024) times higher for Japan, but not significant, when pm10 is increased by 10μg/m^3. We did not observe significant modification effect of PM10 on mortality by extreme low temperature. Conclusion: We observed extreme high temperature increases the associations of particulate pollution with daily mortality. These findings suggest that the health impact might be considered with interaction of air pollution and climate change.

Abstract Number	**P-3-03-13**
Presenter	Eric Lavigne*, Xiang Wang, Rose Dugandzic, Frances Coates
Exposure	ambient air pollution
Health domains	allergies
Type of research	time series study

Effect modification of ambient air pollution in the associations between aeroallergens and allergic disease medication relievers in Ontario, Canada

Background: Ambient air pollution may modify the effect of aeroallergens on allergic diseases through enhanced inflammatory processes. However, further evidence is needed in order to clarify this effect modification influence. Aims: Investigate the effect modifying influence of outdoor air pollution in the associations between daily levels of ambient aeroallergens and daily numbers of medications sold to relieve allergic diseases such as asthma, allergic rhinitis and conjunctivitis. Methods: This study uses a multi-city time series approach by including seven cities in the province of Ontario, Canada. In each city, daily levels of aeroallergens (tree, pollen, mold) taken from fixed site monitoring stations from years 2007 to 2011 were obtained. Daily numbers of prescription and over-the-counter (OTC) medication sales used to relieve symptoms of asthma, allergic rhinitis and conjunctivitis were also obtained for the same time period for each city. A distributed lag Poisson regression model adjusted for seasonal trends, day-of-the-week, temperature and relative humidity was used by including interaction terms between aeroallergen levels and a dichotomized variable (low/high) characterizing levels of specific air pollutants (NO2, PM2.5, CO, O3 and SO2). Results were pooled across all cities using random effects model. Results: The relative risks characterizing the associations between daily pollen levels and daily medication reliever sales for asthma and allergic rhinitis were stronger on days with elevated levels of PM2.5 compared to days with lower levels (P value for interaction < 0.05). Relative risks (95% confidence interval) for an interquartile increase in tree pollen levels ranged from 1.15 to 1.30 on days of high PM2.5 levels. Conclusions: Results of this study suggest that ambient air pollution enhance the effect of pollen on asthma and allergic rhinitis. A reduction in ambient air pollution levels could reduce allergic exacerbations of asthma and allergic rhinitis.

Abstract Number	**P-3-03-14**
Presenter	Lital Yinon-Wolf*, George Thurston, Eric Amster
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Effect of Intervention Activities to Control Air Pollution on Mortality in Three Israeli Cities

Background: Increased exposure to air pollution is associated with increased risk of morbidity and mortality. However, the health benefits of lowering air pollution levels are not as well documented. A better understanding of the after effects of interventions to reduce air pollution is needed in order to: 1) confirm the benefits of lowered air pollution; and, 2) identify the types of reductions that effectively provide health benefits Aims: This study analyzes daily health and pollution data from three major cities in Israel that have recently undergone intense interventions to reduce sulfur emissions from combustion sources. In this work, we test the hypothesis that a reduction in the sulfur content of combustion fuels is associated with decreased risk of daily cardiovascular mortality Methods: Poisson regression models are applied to evaluate the association between daily air pollution and mortality in each city in order to test whether the interventions were associated with a statistically significant reduction in mortality. This is accomplished by comparing the time-series model coefficients derived pre- vs. post-intervention in each city Results: Mean hourly SO2 concentration decreased significantly in all three cities following interventions, accompanied by a decrease in cardiovascular mortality counts. Similar reductions were not observed in overall PM2.5. Exploratory regression analyses indicate a significant association between daily mortality and SO2, but not with PM2.5 mass in these cities. While results vary somewhat across the cities, the size of the SO2 mortality effect estimates (per µg/m3) diminish following intervention, which may indicate that SO2 is serving as a marker for an SO2 associated PM2.5 component Conclusions: Preliminary results show a decreasing SO2 concentration trend that coincides with a decreasing cardiovascular mortality trend, and that the effect estimates (per µg/m3) decreased after interventions, suggesting a reduction in the toxicity of air pollution following reductions in fossil fuel combustion sources

Abstract Number	**P-3-03-15**
Presenter	Hyewon Lee, Ho Kim*, Yasushi Honda, Yue-Liang Guo, Youn-Hee Lim, Na-Kyung Kim
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Effects of Asian dust storms on mortality in three Asian cities

Asian dust storms have affected several Asian countries being major issues for public health. ADS have different effect size on each country according to its geographical features. Considerable studies have found significant associations between ADS and morbidity. However, regarding the association between ADS and mortality, Japan found no association and in Taiwan and Korea, a few studies showed statistically significant ADS effects. This study aims to explore the effect of ADS on daily mortality in three Asian cities (Seoul, Taipei, Kitakyushu) and to find the different ADS effect by each city. We performed time-series analyses using genaralized additive model with Quasi-poisson regressions. PM10, relative humidity, barometric pressure, day of the week, temperature, season and time trends were controlled. We considered the single lag effect of ADS up to 7 days and adjusted for same lag day's PM10 concentrations. We found consistent results in Seoul as follows. ADS had adverse effects on all deaths(lag2-RR: 3.73%; 95%CI: 0.32,7.26) and circulatory deaths(lag1-RR: 7.79%; 95%CI: 1.05,14.99), whereas for respiratory deaths, ADS had protective effects(lag0-RR: -20.60%; 95%CI: -36.94,-0.02). In Taipei, ADS had protective effect on all deaths(lag0-RR: -3.52%; 95%CI: -6.27, -0.70), respiratory deaths(lag0-RR: -11.04%; 95%CI: -17.68,-3.86) and circulatory deaths(lag0-RR: -16.85%; 95%CI: -28.97,-2.67). In Kitakyushu, we found opposite results to Taipei. ADS had adverse effects on respiratory deaths(lag2-RR: 23.21%; 95%CI: 4.43,45.37) and circulatory deaths(lag0-RR: 53.94%; 95%CI: 9.13,117.14). We concluded that these results might be due to the difference in the number of ADS days by cities. Taipei has been affected by ADS frequently, so that people in Taipei might be more alert to ADS. Whereas, Kitakyushu is located relatively far from the origins and the least affected among three cities. Thus people in Kitakyushu might not be so worried than other two cities. Also, these results might suggest the effect of dust warning system to protect people.

Abstract Number	**P-3-03-16**
Presenter	Liqiong Guo*, Andrea A Baccarelli, Hyang-Min Byun, Valeria Motta, Jitendra Barupal, Chang Dou, John P. McCracken, Joel D. Schwartz, Sheng Wang, Lifang Hou, Andrea A Baccarelli
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-control study

Effects of Short-term Exposure to Inhalable Particulate Matter on Tandem Repeats DNA Methylation

Particulate Matter (PM) has been associated in epidemiology investigations with lung cancer risk and mutagenicity. PM exposure has been linked with blood DNA hypomethylation, an epigenetic alteration associated with cancer risk, but previous investigations have almost exclusively focused on a limited set of repeated-element sequences from LINE-1 and Alu families. Tandem-repeats – highly-represented sequences hypomethylated in cancer patients – have never been investigated in PM-exposed individuals. We measured methylation of three tandem repeats (SATα, NBL2, D4Z4) by PCR-pyrosequencing in two groups with high PM exposures, including 120 blood samples from truck drivers and 120 blood samples from office workers in Beijing, China. We measured personal PM2.5 (PM with aerodynamic diameter ≤2.5 μm) and Elemental Carbon (EC, a tracer of traffic particles) using light-weight monitors. Ambient PM10 data were obtained from local stations. An interquartile increase in personal PM2.5 and ambient PM10 levels was associated among all participants with a significant covariate-adjusted decrease in SATα methylation (-1.35%5mC, p-value=0.01; and -1.33%5mC; p-value=0.01, respectively). Effects from personal PM2.5 and ambient PM10 on SATα methylation were stronger in truck drivers (-2.34%mC, p-value=0.02; -1.44%mC, p-value=0.06) than office workers (-0.95%mC, p-value=0.26; -1.25%mC, p-value=0.12, respectively). Ambient PM10 was negatively correlated with NBL2 methylation in truck drivers (-1.38%mC, p-value=0.03), but not in office workers (1.04%mC, p-value=0.13). EC showed no effects on tandem-repeat methylation. In summary, PM exposure was associated with hypomethylation of selected tandem repeats. Measures of tandem-repeat hypomethylation in easy-to-obtain blood biospecimens may help identify individuals with PM biological effects and potentially related to cancer risk.

Abstract Number	**P-3-03-17**
Presenter	Vivian C. Pun*, Hong Qiu, Kin-fai Ho, Ignatius T. S. Yu, Linwei Tian
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Emergency hospital admissions for cardiorespiratory diseases and PM10 chemical composition in Hong Kong

Background: Research on how individual chemical components of PM affect human health has been focusing on fine particles (i.e., PM2.5). PM composition differs by size, with more crustal materials in coarser PM and more combustion-related components in finer PM, and thus their associated health risks could differ. Evidence regarding the health impacts on PM10 chemical composition is scarce.Aims: We examined the short-term association between PM10 composition and daily emergency hospital admissions in Hong Kong.Methods: Twenty-four hour concentrations of PM10 mass and eighteen components from six general air monitoring stations, daily cardiovascular (CVD) and respiratory (RESP) hospital admission data and meteorological measurements were obtained. Generalized additive models were used for the analysis.Results: Between 2001-2007, daily average concentration of PM10 mass in Hong Kong was 54.3 μg/m3. Major contributors to PM10 included organic matter (OM), sulfate, elemental carbon (EC), nitrate, and ammonium. After adjusting for weather, seasonal/time trends, day-of-week and influenza epidemic, an inter-quartile range increment in nitrate (3.4 μg/m3) was associated with 1.8% (95% CI: 1.1-2.5 at lag 0 day) and 1.6% (95% CI: 1.0-2.3 at lag 3 day) increase in CVD and RESP hospital admissions respectively. Similar associations with OM were also found. EC, trace metals (iron, nickel, vanadium) and water-soluble ions (ammonium, sodium, potassium, chlorine ion) were linked with increased hospital admissions, particularly in the cool season. Stronger effects were observed for admissions among elderly (≥65 years) and RESP admissions among men.Conclusions: Ambient levels of secondary particles (nitrate) and OM that is primarily from combustion were associated with the largest risks of hospital admissions across the PM10 components in Hong Kong. Potential seasonal influence and effect modifiers for PM10 composition-related health effects warrant further investigation.

Abstract Number	**P-3-03-18**
Presenter	Aurelio Tobias*, Cristina Reche, Angeliki Karanasiou, Fulvio Amato, Jorge Pey, Patrica García de Olaya, Joan A. Cayla, Andrés Alastuey, Xavier Querol
Exposure	ambient air pollution
Health domains	other
Type of research	case-crossover study

Health effects of black carbon in the city of Barcelona

Background. Current air quality standards for particulate matter (PM) use the mass concentration of PM with aerodynamic diameters ≤2.5 µm (PM2.5) and ≤10 µm (PM10) as metric. It has been suggested that particles from combustion sources are more relevant to human health than particles from other sources. However, only few studies have assessed for adverse health effects of black carbon (BC) as an additional in air quality indicator in Europe. Aim. To investigate the short-term effects of BC on total daily mortality, in the city of Barcelona (Spain). Methods. We collected daily burials due to natural causes, as indicator of total daily mortality, and daily 24h average levels of BC, PM2.5 and PM10 between 2009 and 2012. We used a time-stratified case-crossover design with Poisson regression allowing for overdispersion. BC estimates are compared with those obtained with the usual indicators of PM mass. Results. Estimated health effects of an interquartile range increase were greater for BC than for PM2.5 and PM10. An increase of 1.4 µg/m3 in BC increased mortality by 3%, while an increase of 10.5 µg/m3 in PM2.5, and of 17.0 µg/m3 of PM10, increased mortality by <1%. Two-pollutant models showed that effect of the BC was more robust than effect of the PM mass. Conclusions. BC is a valuable additional air quality indicator to evaluate the health risks of air quality dominated by primary combustion particles, , in our case by road traffic emissions.

Abstract Number	**P-3-03-19**
Presenter	Enkhjargal Altangerel*, Batbaatar Suvd, Badrakh Burmaajav
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Health impact assessment (acute chronic CVD and RSD) of ambient air ??10 and PM 2.5 of Ulaanbaatar city

Purpose: To determine the relationships between air pollutants (PM10, PM2.5, NO2 and SO2) and meteorological parameters (average temperature, humidity, and wind speed) with acute and chronic respiratory and cardiovascular disease admission of all secondary level and tertiary level hospitals of Ulaanbaatar and 8 primary level hospitals of Mongolia. Method: This is cross sectional survey which collected data (above mentioned air quality and health data) during 1 year and 5 days or 370 days from 1 June 2008 to 5 of June 2009. Results: Relative humidity, PM2.5 level, SO2, NO2 and PM10 level were directly correlated with acute respiratory system disease admission cases. Whereas, PM10, PM2.5, and SO2were directly correlated with acute cardiovascular disease admission cases. The direct correlation with total acute disease admission cases was observed between sulfur dioxide, PM10 level and PM2.5 level. The direct correlation of both chronic disease admission cases with PM10 level was observed. Also direct correlation between PM2.5 level with chronic respiratory system disease admission and PM2.5 level with total chronic disease admission were determined correspondently. Acute disease admissions were more effected to the same day and it was more influenced than the chronic disease admission. Conclusions: PM2.5 exposure for the respiratory and cardiovascular system chronic disease admission was significantly higher than the PM10 level. There are significant correlations between respiratory and cardiovascular morbidity with PM2.5, PM10, NO2, SO2 and some meteorological parameters

Abstract Number	**P-3-03-20**
Presenter	Myriam Mrad Nakhle*, Isabella Annesi-Maesano, Nelly Ziade, Maher Abboud, Wehbeh Farah
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Impact of air pollution on health in Beirut- BAPHE (Beirut AirPollution and Health Effects) protocol and results

Background In the past few years, Saint-Joseph University (USJ) through its Air Quality Research Unit has taken up a long-term process to set-up a permanent air quality monitoring system. Results of air pollution assessment disseminated for public and decision makers exceeded the WHO standards. Aims Our specific aim is to conduct a descriptive epidemiological study for 18 months in 7 hospitals in the city of Beirut in order to evaluate the association between health indicators and specific pollutant levels NO2, PM10 and PM2.5. Methods The study is based on time series analysis comparing short-term (daily) variations in exposure with short-term variations in population health, using daily emergency visits and hospitalization count as health indicators for respiratory, cardiovascular, cerebrovascular and allergic diseases. Results Several data sources are examined to identify the most appropriate source. Clinical terms are identified and classified. The health indicators finally adopted are admissions through emergency units for: respiratory diseases (Codes ICM 10: J00-J99), cardio-vascular diseases (Codes ICM 10: I00-I99), cerebrovascular diseases (Codes ICM 10: I60-I64 and G43- G46) and allergic disease (Codes ICM 10: L50-L54 and T886). In addition, information on gender, age and the treatment given for the patients at the emergency units are collected. Quality assurance procedures for data management and archiving are elaborated. Data for more than 12000 individuals presenting respiratory and other diseases considered in BAPHE have been collected and analyzed for 12 months. The results of 18 months 'study will be disseminated and published in May 2013 and during the Conference of ISEE, ISES and ISIAQ in Basel, Switzerland (August, 2013).Conclusions BAPHE took into consideration all the suggestions made by these studies in order to respond to an inherent need to quantify the effect of air pollution on health by conducting an eco-epidemiological study.

Abstract Number	**P-3-03-21**
Presenter	Andrea Winquist, James Schauer, Jay Turner, Mitch Klein, Stefanie Sarnat*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Impact of ambient PM2.5 carbon measurement methods on observed associations with acute cardiorespiratory morbidity

Background: Organic (OC) and elemental carbon (EC) represent a substantial portion of airborne particulate matter <2.5 µm in diameter (PM2.5), and have been associated with adverse health effects. Two common EC/OC measurement methods use thermal optical transmittance (eg, the NIOSH method) and thermal optical reflectance (eg, the IMPROVE method). These methods can differ in how carbon particles are apportioned to EC and OC. The U.S. Speciation Trends Network (STN) recently changed from a NIOSH-like method to the IMPROVE method. Few data are available about potential impacts of this change on health effect study findings. Aims: We compared acute associations between cardiorespiratory emergency department (ED) visits in St. Louis during 6/2001-4/2003 and PM2.5 EC and OC measurements from NIOSH-like and IMPROVE methods. Methods: Daily speciated PM2.5 data were obtained from the St. Louis-Midwest Supersite. Associations between daily EC and OC measurements and ED visit counts were assessed using Poisson generalized linear models controlling for temporal trends and meteorology. Results: Associations with EC and OC measurements were most apparent for cold season cardiovascular disease (CVD) ED visits and warm season respiratory ED visits. Associations were generally similar between measurement methods, but some differences were observed, particularly in the warm season. For example, we observed stronger warm season CVD-EC associations for NIOSH than IMPROVE, and stronger warm season asthma/wheeze-EC associations for IMPROVE than NIOSH. Conclusions: Previous studies have found highest ratios of IMPROVE to NIOSH-like EC measurements in summer in St. Louis, and EC differences between methods have been associated with secondary organic aerosols and biomass burning. Observed differences in ED visit associations may reflect differences between methods in the composition of particulate matter assigned to EC and OC.

Abstract Number	**P-3-03-22**
Presenter	Martina Gandini*, Giorgio Cattani, Massimo Stafoggia, Giovanna Berti
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Influence of air quality data estimation on short-term health effect estimates of air pollution in epidemiological studies

Background In time series studies, daily missing values of air pollutants are generally imputed, but how this affects epidemiological risk estimates is not clear. Aims To quantify the influence of missing data imputation methods on short-term health effects estimates. Materials and Methods Daily counts of natural mortality and PM10, NO2 and O3 daily concentration were collected for Milan, Rome and Palermo during 2001-2005. Simulation of missing data patterns on air pollutant were done in two scenarios by removing 10% and 20% existing values. Three different imputation methods were applied: Epiair1 (E1), based on mean in the same day of the other city-specific monitoring stations, weighted by the relative annual mean between stations, Epiair2 (similar to E1, but with weights based on seasonal means) and average of previous and following day (for isolated missing values). The effect of pollutants on mortality was evaluated using Poisson regression models, and estimating percent increases of risk of natural mortality for ten unit increases in the pollutants. For each city and method, a set of 1000 simulations was performed. Results Effect estimates obtained with methods E1 and E2 remained close to the reference value for all the cities and pollutants investigated. The poorest result (NO2 in Palermo, under 20% missing value scenario) showed a very good agreement between the original dataset [3.32 (95% C.I. 1.33; 5.35)] and the E1 [3.24 (0.91; 5.54)] and E2 [3.29 (0.88; 5.45)] estimates (in brackets the minimum of lower 5% confidence limits and the maximum of the upper 95% of the confidence limits obtained from the simulations are reported). Results were much less precise using time series without imputing missing data or using the method of average - in the example 3.29(-1.80; 8.29) and 3.49(-0.69; 8.64). Conclusions This study adds new elements to the knowledge about the estimation of environmental missing values and mortality risk estimates. Methods currently used in environmental epidemiology are robust for different pollutants and the cities considered.

Abstract Number	**P-3-03-23**
Presenter	Mathilde Pascal*, Magali Corso, Vérène Wagner, Edouard Chatignoux, Christophe Declercq
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Influence of the PM10 measurement techniques on the assessment of the short-term mortality impacts of PM10

Background and aims: In France, before 2007, particulate matter (PM) was measured with Tapered Element Oscillating Microbalance (TEOM). This method systematically under-estimated PM concentrations compared to the gravimetric reference method. Since 2007, concentrations are measured with TEOMs equipped with a Filter Dynamics Measurement System (TEOM-FDMS), which correct for the loss of semi-volatile compounds, and provide values consistent with the gravimetric method. We investigate how this change in measurement techniques influenced the estimates of the impacts of PM10 on mortality. Methods: The analysis was performed in nine French urban areas, for the period 2000-2006 (using TEOM data) and 2007-2010 (using TEOM-FDMS). The associations between PM10 and non-accidental, cardiovascular and respiratory mortality were investigated in each city using a generalized additive Poisson regression model. The mean levels of PM10 observed during the current and the previous day were introduced as a linear term. The percent increase in the mortality rate was estimated for a 10 µg/m3 increase in PM10 levels for the whole year and by season. City specific results were combined using random effect models. Results: PM10 were consistently higher during 2007-2010 (+5.9 µg/m3 on average) with strong seasonal variations. Estimates of the mortality increase for a 10 µg/m3 increase in PM10 were similar between the two periods, with the largest estimates observed during summer (e.g. non-accidental mortality: +3.2% [1.8:4.7] for 2000-2006 and +2.0% [0.8:3.3] for 2007-2010), and the lowest during winter. The main difference was observed for respiratory mortality during summer (-0.5% [-6.3:5.8] for 2000-2006 and +3.8% [-1.9:9.2] for 2007-2010). Conclusions: Despite large differences in the PM10 concentrations reported between 2000-2006 and 2007-2010 due to different measurement techniques, the concentration-response functions were similar across the two periods. This suggests that the semi-volatile part of PM10 have a similar impact on mortality.

Abstract Number	**P-3-03-24**
Presenter	Andrea Winquist*, Ellen Kirrane, Mitch Klein, Strickland Matthew, Lyndsey Darrow, Stefanie Sarnat, Katherine Gass, James Mulholland, Armistead Russell, Paige Tolbert
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

Joint effects of air pollutants on pediatric asthma emergency department visits

Background: As population exposure to ambient air pollution generally occurs in the form of mixtures, consideration of joint effects of multiple pollutants may advance our understanding of associated health effects. Aims: We assess the joint effect of selected pollutant combinations of interest (groups of oxidant, secondary, traffic, industrial, and 5 criteria pollutants) on warm season pediatric asthma emergency department (ED) visits in Atlanta during 1998-2004. Methods: Daily ambient air pollutant concentrations were obtained from several ambient monitoring networks. We examined associations between ambient air pollutant concentrations and the daily count of pediatric asthma ED visits using multi-pollutant Poisson generalized linear models controlling for time trends, meteorology and the number of non-asthma respiratory ED visits. Joint effects of groups of pollutants were calculated for a simultaneous IQR change in the concentration of each pollutant. Results: Statistically significant joint effects were observed for all of the pollutant groups. Joint effects were overestimated if calculated based on results from single-pollutant models rather than multi-pollutant models. Compared with joint effects estimated from multi-pollutant models without interactions, joint effect estimates from models including first order pollutant interactions were not substantially different for oxidant and secondary pollutants, but were slightly higher for criteria pollutants, traffic pollutants and industrial pollutants. Concurvities were high, but power was adequate to calculate joint effects with ample precision. Conclusions: The vast majority of air pollution health effects studies have focused on single pollutant effects, even if multi-pollutant models have been used. Consideration of joint effects can add to our knowledge of how pollutants act together with respect to health effects, and aligns with the recent emphasis on air pollution mixtures.

Abstract Number	**P-3-03-25**
Presenter	Ander Wilson*, Brian Reich, Lucas M. Neas, Ana Rappold
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Modeling the Effect of Temperature on Ozone-Related Mortality

Background: Previous studies show ozone and temperature are associated with increased mortality; however, the joint effect has not been well explored. Understanding the nature of this relationship is important for estimating the potential effects of increasing temperatures on ozone-related mortality. Aims: We propose a model to evaluate joint ozone-temperature risk in multicity studies and evaluate the impact of temperature on ozone-related mortality. Methods: We extend the ozone risk model used by the National Morbidity, Mortality, and Air Pollution Study to include ozone-temperature risk surfaces for 95 US urban centers. These surfaces are modeled using city specific polynomial basis expansion with closed form derivatives to quantify relative risk. To obtain national and regional estimates, at the second stage we use a spatial process prior for spline coefficients and introduce a monotonicity constraint in the ozone direction. This modeling approach is computationally efficient and enables informative smoothing of the risk surface while avoiding over parameterizing the first-stage models. Closed form estimates of the risk surfaces allow for easy comparison of surfaces between cities and regions at all levels of temperature and ozone. Results: Preliminary results based on cross-validation with the NMMAPS data and a simulation study show good model performance, particularly at high concentrations. At the 95th percentile of the city-specific ozone and temperature distributions a monotone model reduces the mean width of 95% posterior intervals by 5.3% while the monotone model together with spatial smoothing reduces the width by 29.6%. We will estimate the effect of rising temperature at all levels of ozone, compare regional heterogeneity, and contrast these results to those obtained using linear and additive assumptions.Conclusions: Initial analysis suggests that the ozone effect is nonlinear and that temperature confounds the ozone effect in a nonlinear manner. Disclaimer: This abstract does not necessarily reflect U.S. EPA policy.

Abstract Number	**P-3-03-26**
Presenter	Zhe Liu*, Baoxin Zhao, Zhiqin Zhang, Xiaoping Zhang, Ligang Ma, Yanping Zhang, Baoqing Feng, Haiping Li
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Non-linear Shapes of Concentration-Response Function for Particulate-Matter-related Mortality in High Concentration Range: Evidence from Taiyuan, China

Background: Several studies had examined the shape of concentration-response function (CRF) between airborne particles and daily deaths in low concentration range of air pollution, and had reported linear relations without significant threshold, however, the shape of CRF in the high concentrations range remains poorly explored. Aims: To explore and discuss the shapes of CRFs between PM10 and daily mortality in the high concentration range of 13.14-508.43μg/m3 in Taiyuan, China. Methods: We used generalized additive models (GAM) with log link and Poisson error to estimate the shape of the concentration response function. Since estimated CRFs were nonlinear, we used constrained piecewise linear functions to estimate the relative risks, with change points dynamically estimated using a multiple structural change detection algorithm. Cause-specific analyses were performed for both heating and non-heating periods. Results: We identified three shapes of concentration-response curves: C, S, and J. Among which, we observed evident thresholds in S and J shapes, which were located at 60-100μg/m3 range for S, and at 100-250μg/m3 range for J. Risks for non-heating C shapes were found to be significantly higher than risks for other shapes. Conclusions: The result suggested heterogeneity of susceptibility within population. For CRF shapes, C-shape groups were found to be the most susceptible, S-shape less susceptible, and J-shape the least susceptible. For heating periods, non-heating-period groups were found to be more susceptible than heating-period groups. Finally, for causes of death, the susceptibility ranking was (from high to low): respiratory disease, lung cancer, ischemic heart diseases, and cerebrovascular disease.

Abstract Number	**P-3-03-27**
Presenter	Kristi Läll*, Mait Raag, Hans Orru
Exposure	ambient air pollution
Health domains	no health domain
Type of research	time series study

Particulate air pollution and mortality in Tallinn: A time-series analysis in North-Eastern European country

Background: Epidemiological studies have shown that short- and long-term exposure to ambient particulate air pollution is associated with adverse health effects. However, less is known if these patterns also justify in North-Eastern Europe. Aim: Current study aimed to assess if short-term exposure to particulate matter affects the mortality in Tallinn, capital of Estonia. Methods: Daily mortality caused by non-external causes (ICD-10 codes A to R) in Tallinn, was modelled between 2004 and 2011 as dependent on particular matter (PM) concentrations measured in residential area defined as urban background (particle sizes of 10 μm and 2.5 μm, denoted PM10 and PM2.5 respectively) with up to six previous days' concentration, as well as on air temperature, humidity, and season (based on compulsory winter, usually studded tyre period), using general additive models (GAM) with smoothers of time and air temperature. Due to the switch of measure tools in station, the PM variables were standardized. Results: In summer (Apr–Sept), we estimated 3.42% increase (95% CI 1.70–5.16) in daily mortality per 10-μg/m3 increase in PM10 in previous day (lag 1). In winter (Oct–Mar), we estimated 2.11% decrease (95% CI 0.04–4.31) in daily mortality per 10-μg/m3increase in PM10 in previous day. In a summer, 10 μg/m3 rise of PM2.5 in previous day increases mortality by 5.25% (95% confidence interval: 1.98–8.61). In a winter 10 μg/m3 rise of PM2.5 in previous day decreases mortality by 0.86% (95% CI -2.54–4.39). Conclusions: The study showed that days with higher concentration of both PM10 and PM2.5 increase the mortality in Tallinn in the following day during the summer; however, in winter no such trend appeared.

Abstract Number	**P-3-03-28**
Presenter	Hans Scheers*, Lotte Jacobs, Benoit Nemery, Tim S. Nawrot
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	meta-analysis

Particulate matter air pollution and stroke morbidity and mortality: a meta-analysis

Background: Epidemiological studies suggest an association between exposure to particulate matter air pollution (PM) and stroke morbidity and mortality. However, partly due to a lack of statistical power, many study results are inconclusive. Aims: 1) To determine the association between both recent and long-term exposure to PM and stroke morbidity and mortality by performing a meta-analysis. 2) To compare our results for recent PM exposure with data on other triggers of stroke found in the literature. Methods: We searched the Pubmed citation database for studies on exposure to PM (both acute and chronic) and onset of stroke (both fatal and non-fatal). All study results were recalculated to ORs for a 10 µg/m³ increment in PM10. Heterogeneity among studies was calculated and funnel plots were created to assess publication bias. Similarly, we searched for papers on other triggers of non-fatal stroke, and we compared risks and PAFs. Results: For recent exposure to PM, the pooled risks for each 10 µg/m³ increment in PM10 on lag day 0 increased by 0.4% (95%CI 0.3% – 0.6%) and 0.7% (0.3% – 1.2%) for stroke mortality and morbidity, respectively. Similar results were obtained for lag days 1 and 2. A 10 µg/m³ increase in long-term PM10 exposure was borderline significantly associated with increases in stroke mortality and morbidity risks of 21% (-1% – 49%) and 7% (-1% – 16%), respectively. Compared to other triggers of stroke, this increase of stroke risk with increasing PM exposure was rather low. However, when taking into account the percentage of the population exposed to each trigger, the PAF of 3.5% for PM exposure was comparable to other triggers (e.g. 4.7% for cocaine use, 2.9% for heavy meal). Conclusions: This meta-analysis indicates that there is evidence for an association between stroke mortality and morbidity and PM exposure. Although individual risk of stroke is rather small, exposure to PM air pollution is a relevant trigger of stroke at the population level.

Abstract Number	**P-3-03-29**
Presenter	Samya Pinheiro*, Paulo Hilário Saldiva, Joel D. Schwartz, Antonella Zanobetti
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	case-crossover study

Particulate Matter and Temperature effects on respiratory mortality, considering socio-economic disparities, Sao Paulo - Brazil: a case-crossover analysis

Introduction: Socio-economic disparities inside large urban areas are a concern to the urban-planners as well to public health and environmental agencies. These disparities may interact with public health issues and environmental problems as air pollution and climate change, resulting a risk and effect harvesting. This study aims to investigating the interaction of environmental risk factors, such temperature and particulate matter, and socio-economic inequality in one of the world largest cities, Sao Paulo - Brazil. Methods: We applied time-stratified case-crossover analysis to 10 years of respiratory mortality daily counts in 35 districts with varrying social characteristics, also aggregated by 5 regions. Modeling of interaction terms and random effects were included to estimate the risk associated with PM10 and temperature based on district and region. Results: The total population results indicate that a 10µg/cm3 increase in PM10 concentration was associated with a higher respiratory mortality risk. The random effects model was not able to detect a significant effect by district, or region data due the stratification. The interaction terms provided an estimation of the effect modification by region. Conclusion: The risk associated with environmental factors may change by differential socio-economic characteristics, as illustrated in this study. The effect harvesting due these disparities highlight the need to draw up action plans by environmental and public health agents focusing on the more susceptible populations.

Abstract Number	**P-3-03-30**
Presenter	Ayano Takeuchi*, Kayo Ueda, Hiroshi Nitta, Toru Takebayashi, Yuji Nishiwaki
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Regional Differences in Acute Health Effects of PM2.5 Using Fractional Polynomial Models. -20 City Study in Japan-

Background and Aims: Last decade, many time series studies have indicated that ambient fine particulate matter (PM2.5) exposure is associated with daily mortality. These results show the harmful effect of PM2.5 but their effect sizes are heterogeneous among countries and regions. Because it is well known that seasonal effects and weather conditions have great influence on the density, measurement and the effect of PM2.5, most studies use generalized additive model with spline function for adjusting these covariates. There are some studies that adjust for the regional differences using meta-analytic method or Bayesian hierarchical model. In epidemiologic studies, regional differences are often treated as random effects. But there is no study based on the mixed-effects model (generalized linear model including random and fixed effects). We apply the fractional polynomial models to our study data. Using fractional polynomial models, we can adjust many covariates like weather conditions and co-pollutants flexibly, and adjust for regional differences using random effects, simultaneously. Our purpose is to detect regional effect of PM2.5. Materials and Methods: Time series data contain daily counts of death (respiratory and cardiovascular causes of death, all cause death without accidental causes) and daily concentrations of air pollutants (PM2.5 using the TEOM, O3, NO2), weather conditions (temperature and relative humidity) in Japanese 20 cities from 2001 to 2007. We apply 1st and 2nd order fractional polynomial models, and choose one model with minimum deviance. We detect regional differences using interaction term between PM2.5 and region. We use Gibbs sampling (approximation algorithm) to solve likelihood function approximately. Results and Conclusions: There are no regional differences of the acute effect of PM2.5 between regions. But when we limited the early spring season (February to May), we detect regional differences between western and eastern side of Japan.

Abstract Number	**P-3-03-31**
Presenter	Ester Rita Alessandrini*, Massimo Stafoggia, Giovanna Berti, Cecilia Scarinzi, Annunziata Faustini, Francesco Forastiere, Ennio Cadum, the Collaborative EPIAIR Group
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Short-term effects of particulate air pollution on mortality in 25 cities in Italy and the role of the individual susceptibility–results of the EPIAIR2 project

Background. A surveillance system (EPIAIR) is ongoing since 2001 in Italy to monitor short-term effects of air pollution. The relationship between PM10 and mortality has been already studied for the period 2001-2005, identifying specific subgroups of population most sensitive to air pollution. Aim. To estimate the association between exposure to PM10 and cause-specific mortality, and to evaluate individual characteristics as potential effect modifiers of this association in an extended period until 2010. Methods. Data on 422,723 natural deaths, age 35+, were collected in 25 Italian cities within the period 2003-2010. Information about cause of death, socio-demographic characteristics and chronic conditions from previous hospitalizations was gathered. Cardiac, cerebrovascular and respiratory diseases were investigated. Exposure data were collected from background monitoring stations. A case-crossover analysis was conducted within each city, followed by random-effects meta-analysis. Results. We found a 0.45% (95% confidence interval [CI]:0.07-0.83) increase in natural mortality for a 10µg/m3 increase of PM10 (lag 0-1). The effect for cardiac mortality lasted several days with an increase of 0.9% (95%CI:0.12-1.68) at lag 0-5. Higher effects of PM10 on natural mortality were found among people aged 85+ years (0.95%, 95%CI:0.39-1.51, p-value of the relative effect modification (p-REM)=0.080), and during summer season (1.51%,95%CI:0.18-2.85, p-REM=0.085). Subjects with previous hospitalizations for diabetes were more susceptible to the effect of PM10 (1.02%, 95%CI:0.30-1.74, p-REM=0.089); previous hospitalizations for anemia, diseases of pulmonary circulation, and heart failure were also suggestive of an effect modification. Conclusions. A strong evidence of a short-term effect of PM10 on natural and cardiac mortality up to the fifth day has been found. Old age, warm season, and diabetes turned out to be significant effect modifiers.

Abstract Number	**P-3-03-32**
Presenter	Massimo Stafoggia*, Ester Rita Alessandrini, Jorge Pey, Annunziata Faustini, Stefano Zauli Sajani, Evangelia Samoli, Jordi Sunyer, Xavier Querol, Francesco Forastiere, Med-Particles Study Group
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

Short-term effects of PM10 from Saharan dust on mortality in Southern Europe - Results of the MED-PARTICLES Project

Background. Enhanced short-term effects of particulate matter (PM) on mortality during desert dust outbreaks have been shown, with controversial results. Aim.To estimate the short-term effects of PM from Saharan dust on mortality in multiple Euro-Mediterranean cities, within the MED-PARTICLES project. Methods. Daily counts of cause-specific deaths were collected for 12 cities from Italy, Spain, Greece and France within 2001-2010. Data were available on daily mean concentrations of PM10 (PM<10 µm), PM2.5 (<2.5µm), PM2.5-10 (PM between 2.5 and 10 µm). Saharan dust episodes were identified using satellite data, operational models and back-trajectories. Daily PM10 concentrations attributable to Sahara were estimated from PM10 observations monitored at rural stations. PM10 from local sources was derived as the difference between total and Saharan PM10. City-specific Poisson regression models were fit, followed by random-effects meta-analysis. Results.The frequency of Saharan dust days ranged between 33% in Southern Greece and 13% in Northern Italy, with highest dust load in the Eastern Mediterranean basin (17 µg/m3 in Athens). Overall, all PM metrics were strongly associated with natural, cardiovascular and respiratory mortality, but no clear effect modification of Saharan dust outbreaks was detected, with high heterogeneity across cities. In contrast, on Saharan dust days, 10 µg/m3 increases in Saharan PM10, lag 0-5, were associated with 5.88% (95% confidence interval: 0.20, 11.88) increased respiratory mortality, with no heterogeneity across cities,while no effect was found for PM10 from local sources (-0.42%; 95% CI: -8.14, 7.95) on Saharan days. Conclusions. We found evidence of effect modification of Saharan dust on PM10-mortality association only in a few cities. A strong homogeneous effect of PM10 from Sahara was found on respiratory mortality. On-going analyses deal to disentangle the effects of Saharan and local sources of PM10 and the heterogeneity of effects. Acknowledgements: MED-PARTICLES EU LIFE10 ENV/IT/327

Abstract Number	**P-3-03-33**
Presenter	Annunziata Faustini*, Massimo Stafoggia, Jorge Pey, Evangelia Samoli, Xavier Querol, Ennio Cadum, Cinzia Perrino, Andrea Ranzi, Jordi Sunyer, Francesco Forastiere, the MED-PARTICLES study group study group
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

Short-term effects of PM10 of Forest Fire on mortality in Southern Europe - Results of the MED-PARTICLES Project

Background. Increased mortality due to particulate matter (PM) from wild and anthropogenic fires has been reported, but results are inconsistent. Identifying PM from wild fires remains a difficult task and in southern Europe, fires are likely to occur in summer, during Saharan episodes. Aim. To estimate the short-term effects of PM from forest fires on mortality in multiple Euro-Mediterranean cities, within the MED-PARTICLES project. Methods. Daily counts of cause-specific deaths were collected for 10 cities from Italy, Spain, Greece and France, within 2001-2010. Data of PM10 (PM<10 µm) and PM2.5 (<2.5 µm) were available on daily mean concentrations. Forest fires days were identified using satellite data (from Naval Research Laboratory) in 3-5-year-period per city. City-specific over-dispersed Poisson regression models were fit, followed by random-effects meta-analysis. Results. The frequency of forest fires days (total n = 321) ranged between 6% in Thessaloniki and 1% in Northern Italy and Marseille; the 27% of fires days come from severe episodes. The fires days were concentrated in summer (70% overall, 97% severe). The fires days overlapped Saharan dust days (36% overall, 59% severe). As expected, a 10µg/m3 increase of PM10 was associated with natural and cause-specific mortality. During fires days, stronger increases of cardiovascular (CV) mortality (lag 0-5; 4.56%; 95% confidence intervals 1.05; 8.19) and respiratory mortality (lag 0-5; 3.45%; 95%CI -2.88; 10.19) were observed, when compared to fires-free days (0.73% and 1.86%, respectively). The effect was homogeneous across the cities and the effect modification of forest fires on CV mortality was statistically significant (p-value of relative effect modification = 0.034). Conclusions. We found evidence of an effect modification of forest fires on PM10-cardiovascular mortality and a strong PM10-respiratory mortality during fires days. Further analyses will be carried out to disentangle the effects of forest fires and Saharan dust PM10. MED-PARTICLES EU LIFE10 ENV/IT/327

Abstract Number	**P-3-03-34**
Presenter	Michikawa Takehiro*, Kayo Ueda, Ryuichi Matsuka, Yusuke Yamamoto, Hiroshi Nitta
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Smoke Fog and the Incidence of Acute Myocardial Infarction in a Time-Stratified Case-Crossover Study

Background: According to the Japan Meteorological Agency, smoke fog is a natural phenomenon that visibility becomes below 10 km due to dry fine particles. In recent decade, the number of smoke fog days increased in western Japan where is close to the Asian continent. This has been considered the effect of trans-boundary air pollutants to be composed primarily of sulfate aerosol. Japanese have great interest in the issue whether smoke fog has the adverse effects on human health, particularly life-threatening diseases such as acute myocardial infarction (AMI), or not. Aims: The association of smoke fog with the incidence of AMI was examined using a time-stratified case-crossover design. Methods: This study included the data of 3,068 patients (2,189 men, 879 women) aged 20 years or older with acute myocardial infarction who were admitted to four general hospitals in Fukuoka, between April 2003 and December 2010. Data on event of smoke fog were obtained from the Japan Meteorological Agency. The occurrence of a smoke fog event was generally determined by visibility-based observation. We also collected air pollutant data from the National Institute for Environmental Studies. Conditional logistic regression model was used to estimate the odds ratios (ORs) for smoke fog in relation to the incidence of AMI, adjusted for 4-day average temperature and humidity. Results: There were 352 days of smoke fog was observed during the study period. The ORs of AMI on smoke fog were 0.98 (95% confidence interval=0.88-1.08) at lag01 (during the case day to a previous day), 0.98 (0.89-1.08) at lag02, 1.00 (0.91-1.09) at lag03, 0.99 (0.91-1.08) at lag04, and 0.99 (0.91-1.08) at lag05. Null association was also observed, though we restricted the data in the season (March-May) when trans-boundary air pollution strongly influences. Conclusions: In the present study, smoke fog did not increase the incidence of acute myocardial infarction.

Abstract Number	**P-3-03-35**
Presenter	Ikuko Funatogawa*, Takashi Funatogawa
Exposure	others
Health domains	other
Type of research	others

Statistical approach when time lags between the start of the exposure and death are very long

Some exposures are started early in the life and dynamically changes in the life course. Mortality caused by the exposure also changes dynamically with age in a population level. For example, many people started smoking in their adolescence or young adulthood, but lung cancer mortality became prominent in elderly. The time lags are more than a half a century. The long time lag and differences between birth cohorts (i.e. people born during same period) make the full impact of the exposure on public health difficult to evaluate. Recently we showed long term trends of the smoking initiation and lung cancer mortality by birth cohort in Great Britain (Funatogawa et al., BMJ open, 2012) and Japan (Funatogawa et al., Bull World Health Organ, in press). Differences among birth cohorts were seen in smoking and lung cancer mortality. These trends with birth year were generally corresponded. For example, the highest levels of lung-cancer mortality were observed in the birth cohorts with the early smoking initiation. However, the trend of the age standardized mortality and the trend of exposure in a population were often compared ignoring birth cohorts. In this study, we show this approach leads to wrong inferences, especially if the exposure changes non-monotonically with birth year. Age specific data of exposure and mortality by birth cohort are more informative. Repeated cross-sectional surveys can provide long term information of age specific exposure in a population level by birth cohort and suited for the monitoring. This work was supported by JSPS KAKENHI Grant Number 80407931.

Abstract Number	**P-3-03-36**
Presenter	Ester Rita Alessandrini*, Massimo Stafoggia, Monica Chiusolo, Martina Gandini, Francesco Forastiere, Ennio Cadum, the Collaborative EPIAIR Group
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

The effects of air pollution on hospital admissions for cardiac, cerebrovascular and respiratory diseases in the multi-city Italian EPIAIR2 study

Background. In Italy the EPIAIR multi-centric surveillance study has already investigated short-term effects of air pollution on cardiovascular and respiratory diseases on hospital admissions from 2001 until 2005 in 10 cities. Aim. To evaluate the impact of different exposures of air pollutants on cause-specific hospital admissions in a larger number of cities (25) and in an extended period (until 2010). Methods. Daily counts of hospital admissions of people (all ages and <14 years) resident and hospitalized in each city were analyzed in the period 2003-2010. A time-series analysis using an over-dispersed Poisson regression model was performed to explore the effects of PM2.5 and PM10 on cardiac, cerebrovascular and respiratory emergency hospitalizations. The single pollutant model was adjusted for time trend, seasonality, and potential confounders. Immediate (lag 0, lag 0-1), delayed (lag 2-5), and prolonged (lag 0-5) effects were evaluated. City-specific results were then combined in a random effects meta-analysis. Results. We found significant increases in cardiac and respiratory hospitalizations for 10µg/m3 increase for PM10 (0.41% lag 0, 95%CI:0.07-0.75 and 0.66% lag 0-5, 95%CI:0.09-1.22, respectively). The same increase in PM2.5 was strongly associated with respiratory diseases (1.30% lag 0-5, 95%CI:0.68-7.93. PM10 and PM2.5 had higher effects on respiratory diseases of children (1.70% lag 0-5, 95%CI:-0.68-4.14, and 3.47% lag 0-5, 95%CI:0.05-7.02, respectively) and at longer lags of exposure. No significant effect was found on cerebrovascular diseases. Heterogeneity between city-specific estimates was negligible, except for respiratory hospitalizations of children. Conclusions. Our results confirm on a wider number of Italian cities the harmful short-term effect of air pollution on morbidity. Specifically, we found strong effects of PM10 and PM2.5 on cardiopulmonary hospitalizations of all-aged people as well as respiratory diseases in children.

Abstract Number	**P-3-03-37**
Presenter	Yuming Guo*, Shanshan Li, Zhaoxing Tian, Xiaochuan Pan, Jinliang Zhang, Gail Williams
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

The effects of air pollution on years of life lost in Beijing, China: a time series study

Background: Undoubtedly, air pollution increases the risk of mortality. However, less evidence is available on the burden of air pollution on years of life lost which combines the counts of deaths with life expectancy. Aims: To better understand the burden of air pollution on deaths, we examine the effects of air pollutants on years of life lost in Beijing, China. Methods: We obtained data on daily non-accidental deaths, air pollutants (PM2.5, PM10, SO2, and NO2) and weather conditions (temperature, relative humidity, and air pressure) in urban Beijing, China, between 2004 and 2008. We examined the association between daily air pollutants and years of life lost, after adjusting for long-term trend, seasonality, day of the week, and weather conditions. Results: All air pollutants had significant impact on years of life lost when we used single pollutant models. The effects of air pollutants on years of life lost appeared acutely and only lasted for 2 days (lag 0–1 days). The effects of air pollutants were alleviated when multiple air pollutants were included into the models. Women and people aged ≤ 65 years were more affected by air pollutants than men and those aged > 65 years, respectively. Conclusions: Using years of life lost provides a novel measure to examine the impact of air pollutants on mortality. Increased years of life lost are associated with air pollution. This study highlights that reducing air pollution is necessary in Beijing, China.

Abstract Number	**P-3-03-38**
Presenter	Xuying Wang, Fengming Dong, Minghao Jin, Xiaochuan Pan*
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

The impact of ambient particulate matter (PM10) on the population mortality for cerebrovascular diseases

The impact of ambient particulate matter (PM10) on the population mortality for cerebrovascular diseases Xuying Wang1, Fengming Dong1, Minghao Jin2, Xiaochuan Pan1 1 Department of Occupational and Environmental Health, School of Public Health, Peking University, Beijing, China 2 School of Public Health, PYONG YANG Medical University, KIMILSUNG University, Democratic People's Republic of Korea Background: Epidemiological studies have reported the associations between increased ambient air pollution and cardiovascular mortality, morbidity and emergency department visits. But the studies of the impact of PM10 on the cerebrovascular mortality are few and the conclusions are not consistent. Aims: To examine the impact of ambient inhalable particulate matter (PM10) on cerebrovascular mortality in Beijing, during 2004-2008. Methods: Both symmetric bidirectional case-crossover design and conditional logistic regression model were used to analyze the associations between ambient PM10 and cerebrovascular mortality. Results: After adjusting the meteorological factors as daily average temperature and relative humidity, the single pollutant model showed that there was no significant lag effect. In the multi-pollutant model, the effect of the every interquartile increase of ambient PM10 had a larger impact on the daily death of the cerebrovascular diseases with statistically significant difference ($P < 0.05$). The effect of ambient PM10 pollution on daily death of cerebrovascular diseases was significant for females, elderly who were 65 or older and winter season. Conclusion: Our data showed that elevated levels of ambient PM10 was positively associated with the increase of cerebrovascular disease mortality. The elevated levels of ambient PM10 could lead to the increase of the daily mortality on cerebrovascular diseases for females, elderly who were 65 or older and in winter season.

Abstract Number	**P-3-03-39**
Presenter	Meimei Xu*, Yunzheng Mo, Xiaochuan Pan
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	time series study

The Interactive Effects between Meteorological Factors and Air Pollutants on Circulatory and Respiratory Mortality in Beijing

Background The interactive effects between meteorological factors and air pollutants were usually examined using generalized additive model (GAM) based on hierarchy in previous studies, but this may break the continuous. Aims We explored and compared the interactive effects between meteorological factors and air pollutants from continuous perspective. Methods Air pollution data (PM10, NO2 and SO2), meteorological data [temperature(T), relative humidity(RH), atmosphere pressure(AP) and wind speed(WS)] and mortality data were collected from 1 January 2006 to 31 December 2009 in Beijing. GAM was fitted with bivariate thin-plate smoothing spline to examine the interactive effect between meteorological factors and air pollutants on circulatory and respiratory mortality. The best model was chosen based on the least deviance criterion. The interactive effects were roughly compared by the absolute value of the estimates and visualized using two-dimensional contours. Results The daily average mortality of circulatory and respiratory disease in Beijing was 82 and 18 respectively. The relatively largest interactive effects for circulatory mortality were NO2-AP, followed by PM10-AP and T-AP. For respiratory mortality, the effect of T-NO2 was largest, followed by NO2–AP and T-AP. Conclusion GAM can be used to explore interactive effect between meteorological factors and air pollutants from continuous perspective. There was difference in the relatively largest interactive effect item for circulatory and respiratory mortality.

Abstract Number	**P-3-03-40**
Presenter	Evelyn Talbott, Judy Rager*, Luann Brink, Stacey Benson
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

The Relationship of Ambient Fine Particulate Pollution (PM2.5) and Cardiovascular Disease Hospitalizations

Objectives: To evaluate the association between cardiovascular disease hospitalizationsand short term changes in PM2.5 in states enrolled in the CDC Environmental Health Tracking Program. A total of 11 states are participating in the study. Methods: Daily 24-hour average PM2.5 and 8-hour maximum ozone levels were obtained from EPA modeled data. A Bayesian space-time downscaler model is used to fuse monitoring data from AQS with gridded output from EPA's Community Multiscale Air Quality (CMAQ) model. State data stewards provided in-patient hospitalization data(and for some also ED data) for 2001-2008. A time stratified case-crossover design was used to estimate the effects of PM2.5 on non-elective hospitalizations for circulatorydiseases (ICD-9 390-459). Odds ratios/95% CIs were calculated for a 10 microgram/m3increase in PM2.5 using conditional logistic regression and adjusting for temperature, dew point, and ozone. Subcategories of cardiovascular disease (CVD), including acute myocardial infarction, stroke, congestive heart failure, and cardiac dysrhythmias, were also examined. Results: Preliminary findings show that in New Jersey, a 10 µg/m3 increase of PM2.5 on the day of admission was associated with a significant increase in circulatory diseasehospitalizations. (OR=1.013, 95%CI 1.009,1.016). Increases in PM2.5 levels were also significantly associated with hospitalizations due to acute myocardial infarction(OR=1.014; 95%CI=1.003,1.026) and congestive heart failure (OR=1.028, 95% CI1.018,1.037). Further work will be presented for hospitalizations and ED visits in additional participating states to include Florida, Massachusetts, New Hampshire, New Mexico, New York, Utah, and Washington. Conclusions: This study demonstrated the use of EPA modeled PM2.5 estimates to examine short term effects of PM2.5 on cardiovascular hospitalizations.

Abstract Number	**P-3-03-41**
Presenter	Jiyoung Son*, Michelle L. Bell
Exposure	ambient air pollution
Health domains	other
Type of research	time series study

The relationships between short-term exposure to particulate matter and mortality in Korea: Impact of particulate matter exposure metrics for sub-daily exposure

Background: Most studies of short-term particulate matter (PM) exposure use 24-hour averages. However, other pollutants have stronger effects at shorter timeframes, which has influenced policy (e.g., ozone 8-hour maximum). Selecting appropriate exposure timeframes is important for effective regulation. The U.S. EPA identified health effects for sub-daily PM exposures as a critical research need. Unlike most areas, Seoul, Korea has hourly measurements of PM10, although not PM2.5. Methods:We investigated PM10 and mortality (total, cardiovascular, respiratory) in Seoul (1999-2009) considering sub-daily exposures: 24-hour, daytime (7am-8pm), morning (7-10am), nighttime (8pm-7am), and 1-hour daily maximum.We applied Poisson generalized linear modeling adjusting for temporal trends and meteorology. Results: All PM10 metrics were significantly associated with total mortality. Compared to other exposure timeframes, morning exposure had the most certain effect with total mortality (based on statistical significance). A 10 µg/m3increase in 24-hour, daytime, morning, nighttime, and 1-hour maximum PM10 was associated with a 0.15% (95% confidence interval 0.02-0.28%), 0.14% (0.01-0.27%), 0.10% (0.03-0.18%), 0.12% (0.03-0.22%), and 0.10% (0.00-0.21%) increase in total mortality, respectively. PM10 was significantly associated with cardiovascular mortality for 24-hour, morning, and nighttime exposures. We did not identify significant associations with respiratory mortality. Conclusions: Results support use of a 24-hour averaging time as an appropriate metric for health studies and regulation, particularly for PM10 and mortality.

Abstract Number	**P-3-04-01**
Presenter	Gillooly Sara*, Leah Cambal, Michael Yonas, Jill Kriesky, Jessica Schmid, Judith Moore, Jane Clougherty, Kyra Shields
Exposure	ambient air pollution
Health domains	other
Type of research	others

A Community-Based Participatory Research (CBPR) Approach to Characterize Perceived Air Pollution "Hot Spots" Using Tree Leaves as Biomonitors

Background: Disproportionate exposure to air pollution leads to environmental justice concerns in urban communities. Existing regulatory monitoring networks do not sufficiently identify variability in intra-urban neighborhood pollution. Community-based participatory research (CBPR) engages community expertise to generate knowledge and examine disparities in environmental exposures. Deciduous tree leaves may prove to be valid biomonitors of air pollution, and such low-cost media are a promising means to engage citizens in monitoring efforts.Aims: We partnered with two youth-focused community organizations to (1) characterize perceived "hot spots,"(2) validate a method of obtaining spatially-resolved air pollution measurements using leaves as biomonitors of outdoor air pollution, and (3) develop a community-driven collaborative plan to improve local air quality. Methods: Perceived "hot spots" were identified based on feedback from community organizations in Braddock and Clairton, PA, areas of social and economic distress located near large industrial facilities. We located candidate Norway maple trees and, together with youth participants, collected leaf samples. Using magnetic and chemical techniques, leaf samples were analyzed for metal constituents of particulate matter. Results: Community participants collected leaf samples, learned analytic methods, and presented results of laboratory analysis at two community meetings. Attendees were educated by youth presenters on health effects of air pollution, relevance of magnetic and chemical results, and provided suggestions for reducing air pollution exposures. Conclusions: Our efforts to utilize knowledge unique to each community contributed to identification of perceived air pollution "hot spots" and to the confidence and engagement of stakeholders in each community. Steps are ongoing to communicate results to local health officials and to increase youth engagement in local air quality improvement efforts.

Abstract Number	**P-3-04-02**
Presenter	Drew Michanowicz*, Jessie Carr, Brett Tunno, Leah Cambal, Sara Gillooly, Jeffrey Howell, Sheila Tripathy, Courtney Roper, Kyra Naumoff-Shields, Jane Clougherty
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

A hybrid Land Use Regression/AERMOD Model for Predicting PM2.5

Background: Land use regression (LUR) models describe spatial relationships between distributed pollutant concentration measures and geographic information systems (GIS)-based indicators of source intensity. As most LUR models include little physical, chemical, or meteorological information, incorporating this information using Gaussian dispersion models should improve model fits. The city of Pittsburgh, PA, is characterized as a complex urban landscape with large industrial point sources contributing to local PM2.5 pollution. Aims: AERMOD (Gaussian plume steady-state air dispersion) model predictions should improve LUR model precision for PM2.5 by incorporating: (1) mechanistic pollutant dispersion from point sources based on emission volumes, (2) planetary boundary layer forcing within complex terrain (hourly meteorological data + digital elevation model), and (3) building downwash, where applicable. Methods: We collected PM2.5 measures from thirty-eight (n=38) sites using Harvard Impactors, in a 500km2 domain. Sites were selected using stratified randomized sampling, capturing variability in traffic density, proximity to industry (weighted emissions), and elevation (a source-concentration modifier). Nine point sources of more than 100 tons PM2.5 annual emissions will be modeled in AERMOD, predicting concentrations at the 38 receptor locations. Predictions from AERMOD will be included as a covariate in a LUR model for PM2.5. Results: Measured PM2.5 concentrations were higher at "near industry" locations (17.8 ± 4.8 µg/m3) vs. other sites (11.7 ± 4.7 µg/m3). Likewise, PM2.5 was higher at "low elevation" sites (15.9 ± 5.8 µg/m3) vs. other sites (13.2 ± 5.4 µg/m3). Conclusions: Incorporating results from source dispersion modeling should improve LUR model fit, albeit under steady-state assumptions. Distinguishable contrasts in PM concentrations at the dichotomized source profiles supports the utility of AERMOD estimates in improving final LUR model fit.

Abstract Number	**P-3-04-03**
Presenter	Shih-Chun Candice Lung*, Christine Wiedinmyer
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Advances in atmospheric chemistry for applications in exposure, epidemiology, and indoor air research

Background: The application of the state-of-the-art technologies and methodologies in the Atmospheric Chemistry field can facilitate the advancement in exposure science, epidemiology, and indoor air research. Aim: The objectives of this presentation are to (1) showcase advanced technologies and methodologies from the Atmospheric Chemistry Community and their application in exposure science, epidemiology, and indoor air research, and (2) to facilitate multidisciplinary dialogues. This presentation will introduce novel tools that can be applied across scales from personal to community levels or from regional to global levels. The technologies/methodologies introduced cover both observational approaches and modelling techniques. Recent developments of light-weight versatile sensors, instrumentation (e.g., the Aerosol Mass Spectrometer) allowing differentiating exposure of freshly emitted aerosols, and remote sensing observations and analyses will be explained. Moreover, the enhanced computer capability worldwide increases the potential of applying sophisticated atmospheric chemistry models with better transport and transformation mechanisms of pollutants than those currently used in health-related research. These models span from local to global scales capturing the finer spatial resolution of pollutant variability critical to exposure and epidemiological studies. These models which will be introduced can be used to estimate more accurate exposure levels in cross-sectional, retrospective, and prospective epidemiological studies. Challenging research questions in exposure science, epidemiology, and indoor air research can be targeted by applying these technologies or collaborating with atmospheric chemists to advance knowledge in human exposure, health impacts, indoor air quality researches. Keywords: atmospheric chemistry modelling, advanced atmospheric chemistry instrumentation, remote sensing technology

Abstract Number	**P-3-04-04**
Presenter	Eusébio Conceição*, Daniel Geraldo, João M. M. Gomes
Exposure	ambient air pollution
Health domains	other
Type of research	others

Application of a Centrifugal Vane Mist Eliminator in the Gaseous Effluent Treatment in the External Environmental Air

The treatment of the gaseous effluents released to the atmosphere influences the external air quality. In the last years different equipments used in the treatment of gaseous effluent were developed. However, the treatment level is influenced by the equipment performance. In this study the treatment of gaseous effluents released to the external environmental air with a centrifugal vane mist eliminator is made. In this study, using experimental tests, the equipment performance is analysed in detail. The centrifugal vane mist eliminator is made with stainless steel zig-zag and semi-circular deflectors. The measurement is made inside the zig-zag deflectors in the semi-circular deflectors entrance. In this study the air velocity fluctuations experimental measurements, for two typical inlet air velocities, are made. The root mean square, the turbulence intensity and the power spectra, using the Fourier methodology, are calculated. In the final paper the detailed pictures of the equipment are also presented. In accordance with the obtained results, for the two typical inlet air velocity, the mean air velocity, the air velocity root mean square, the air turbulence intensity and the power spectra energy values, in general, increase from the first to the central semi-circular deflectors and is practically constant in the followings. The mean air velocity, the air turbulence intensity and the power spectra energy values are higher for the high inlet air velocity than for the low inlet air velocity. It is also verified that the mean air velocity values in the external zig-zag deflector are smaller than the central zig-zag deflectors.

Abstract Number	**P-3-04-05**
Presenter	Chang-Fu Wu*, Cheng-Pin Kuo, Ho-Tang Liao
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Application of a modified receptor model for apportioning air pollutants based on data with multiple time resolution

Background: Volatile organic compounds (VOCs) and fine particulate matter (PM2.5) usually are monitored with different sampling time schedules, resulting in difficulties for conventional receptor modeling. Aim: We applied an improved receptor model that is suitable for incorporating data with multiple time resolutions for source apportionment of air pollutants. Methods: A field campaign was conducted at a Photochemical Assessment Monitoring Station (PAMS) of Taiwan EPA, which provided hourly VOCs measurements. Additional 12-hr PM2.5 samples were collected for one week and analyzed for elemental content and ionic species. A Multilinear Engine program, modified for modeling hourly VOCs and 12-hr PM2.5 data in one input matrix, was applied to resolve the source profiles and contributions. Results: The input dataset included 38 VOCs, 12 PM2.5 elements, and 6 ions. Alkanes and SO42- was the species with the highest mass percentage for VOCs and PM2.5, respectively. Five factors were resolved from the Multilinear Engine program. They resembled sources of transported pollutants, secondary sulfate, evaporative emissions, industrial processing, and vehicular emissions. For VOCs, the third and fifth factors were the largest contributors. For PM2.5, the first and third factors accounted for more than 50% of the measured mass concentration. Conclusions: The modified Multilinear Engine program was applied successfully for a dataset with multiple time resolutions. Inclusion of additional characteristic species may further improve the model interpretability.

Abstract Number	**P-3-04-06**
Presenter	Olorunfemi Adetona*, Christopher Simpson, Gretchen Onstad, Luke P Naeher
Exposure	others
Health domains	no health domain
Type of research	occupational study

Assessment of Occupational Exposure of Forest Firefighters to Woodsmoke Using Levoglucosan, Particulate Matter and Carbon Monoxide

The exposure of wildland firefighters at prescribed burns and wildfires have typically being assessed using particulate matter and carbon monoxide (CO). Levoglucosan (LG), a major organic constituent of particles in woodsmoke, was measured and used together with particulate matter with median aerodynamic diameter of 2.5 microns (PM2.5) and CO to assess the exposures of eighteen wildland firefighters at 30 prescribed burns (n=157 person-days) at the Savannah River Site (SRS), SC. The effects of various factors on the exposure of the firefighters were investigated using linear mixed effects models. Exposures to PM2.5 (64-2068 µg/m3) and CO (0.02-8.2 ppm) averaged over the work-shift duration fell within the ranges observed in previous studies. Some recommended shorter term exposure limits for CO were exceeded in a few instances. The LG:PM2.5 ratio averaged 6.9% (95% CLs: 5.4, 8.5%) with nine samples having a ratio below 1%. Exposure to PM2.5 and CO were higher when firefighters performed “holding” tasks compared with “lighting” duties, while exposures to CO and LG were higher when burns were in compartments with predominantly pine vegetation ($p<0.05$). The very low LG:PM2.5 ratios in some samples suggest that the exposures of wildland firefighters to pollutants at prescribed burns may be substantially impacted by non-woodsmoke sources.

Abstract Number	**P-3-04-07**
Presenter	Kuzmina Elena*, Vladimir Gurvich, Sergei Kuzmin
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cross-sectional study

Assessment of the Inhalation Toxic Exposure for Children Living in Urban Areas

Objectives. To assess the risks for children due to inhalation toxic exposures. . Methods. Our studies were carried out in 2003-2010 in kindergartens of 9 industrially polluted towns of the Sverdlovsk Region, Russian Federation, covering 350 children aged 3 to 7. The following personal samplers were used for measuring concentrations of chemicals in ambient and indoor air and in the breathing area of children: CHEMEXPRESSTM (USA) – for formaldehyde; OGAWA Co. (Japan) – for nitrogen dioxide and sulfur dioxide; 3M ORGANIC VAPOR MONITOR 3500 – for volatile organic compounds (VOC); “Breeze-1” (Russia) for heavy metals. Concentrations of lead, copper, zinc, cadmium, arsenic, nickel, and chromium were measured also in dust samplers, and soil by mass spectrometry with inductively coupled plasma. We conducted timekeeping and used a special questionnaire to detect individual risk factors. Results. The timekeeping showed that almost 80% of time children spent indoors. Personal factors of inhalation risk included dwelling in the vicinity of industrial enterprises, predominance of synthetic decoration materials at home, gas stove in the kitchen, smoking of parents, etc. Children’s personal exposure to VOC, formaldehyde and nitrogen dioxide, with account for the pattern of daily activities, was mainly attributed to indoor air concentrations of those chemicals, and sulfur dioxide – to both indoor and ambient concentrations. Conclusions. Inhalation exposure assessment is very important for the assessment of integrated environmental exposure to toxicants, enabling one to develop an strategy risk management for the children as the most sensitive population.

Abstract Number	**P-3-04-08**
Presenter	Julie Fox*, Sun-Young Kim, Joel Kaufman, Timothy Larson, Sverre Vedal
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

Development of a Spatio-Temporal Model of Air Pollution Source Apportioned Factors in a Multi-Ethnic Study of Atherosclerosis (MESA) Region

BACKGROUND. The National Particle Component Toxicity (NPACT) Study aims to investigate the association between participants’ exposure to PM2.5 air pollutant components and health effects. Spatio-temporal models were developed for NPACT to characterize PM2.5 components. Here we extend this analysis using positive matrix factorization (PMF) to derive multivariate pollutant features in each MESA area. AIM. To develop a spatio-temporal model based on PMF factor scores derived from fine particle species measurements. METHODS. PMF models were developed from sampling observations collected from multiple sites for each MESA clinic area. Here we present data from the Baltimore area. The PMF model had 8 multivariate features. We chose 2 of these features for further analysis: diesel exhaust/brake wear and secondary sulfate. We then built spatio-temporal models using a large suite of geographic covariates and geostatistical smoothing methods to predict these features. RESULTS. Within PM2.5, 7% was attributed to diesel/brake wear and 36% to secondary sulfate. The secondary sulfate factor showed a stronger temporal pattern whereas the diesel/brake wear factor gave a stronger spatial pattern. The estimated temporal trend of secondary sulfate was higher in summer, lower in winter and generally homogeneous across the area. For the diesel/brake wear factor, 72% of variability of the computed long-term means was explained by geographic variables related to road network, elevation, and land use. CONCLUSIONS. These results are consistent with our hypotheses of expected spatial and temporal trends of diesel exhaust and secondary sulfate features. This suggests that further application of factorization approaches may enhance our understanding of temporal and spatial characteristics of sources in epidemiological research. This serves as the first step in developing factor-based spatio-temporal model predictions of exposure to air pollution sources for the entire MESA cohort.

Abstract Number	**P-3-04-09**
Presenter	Linda Phillips*
Exposure	others
Health domains	no health domain
Type of research	others

EPA-Expo-Box: A Web-Based Toolbox for Exposure Assessors

PRESENTATION ABSTRACT ISES 2013 Basil, Switzerland, August 2013 Phillips, Linda U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC, USA EPA-Expo-Box: A Web-Based Toolbox for Exposure Assessors EPA EXPOsure toolBOX, or EPA-Expo-Box, is a web-based toolbox that has been developed by EPA's Office of Research and Development (ORD), National Center for Environmental Assessment (NCEA). It is intended for exposure and risk assessors and it comprises a series of Tool Sets that guide users through the exposure assessment process with a user-friendly format. The Tool Sets include: Exposure Assessment Approaches; Exposure Media; Exposure Routes; Potentially Exposed Populations; Tiers and Types of Exposure Assessment; and Chemical Classes. Each Tool Set provides annotated links to databases, models, guidance documents, and reference materials used in human exposure assessment. Using a search interface and key terms, users can identify relevant tools from among the 500+ resources included in EPA-Expo-Box. EPA-Expo-Box also includes a module featuring EPA's Exposure Factors Handbook and related tools. The Exposure Factors module provides a bookmarked version of the EPA Exposure Factors Handbook: 2011 Edition allowing for easier navigation; highlights of the data and recommendations for each factor; a summary of recommended values in Excel spreadsheet format; nearly 300 data tables in downloadable Excel spreadsheet format; and links to over 700 source references. There is also a user-friendly interface to allow users to search the Exposure Factors Handbook: 2011 Edition for relevant tables based on key words or phrases. This presentation will introduce EPA-Expo-Box and highlight some of its key features. Keywords: exposure, tools, databases, models, guidance Dr. Linda Phillips (703) 347-0366 Phillips.linda@epa.gov

Abstract Number	**P-3-04-10**
Presenter	Jae-Eun Kang*, Yoo-Keun Kim, In-Bo Oh, Jin-Hee Bang, Yoon-Hee Kang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Estimating population exposure to high ozone concentrations under major meteorological conditions in a coastal city

Background: Recent climate change and urbanization enhance the interest in ozone (O3) exposure in vulnerable population. Further advances in exposure assessment technology will be needed for quantifying population exposure to high O3 levels in complex coastal urban area. Aims: In this study, the population exposure to high O3 concentrations was estimated under the major meteorological conditions in a coastal city. Methods: We estimated the population exposure in Busan metropolitan city in Korea by matching O3 concentrations predicted by meteorological-air quality models (WRF-CMAQ) with geographically distributed population. The population data for 2000 were obtained from the Statistics Korea classified by age, gender, and the smallest administrative unit. The distributions of the estimated population exposure to high O3 concentration were compared between the different wind conditions on the high O3 days. Results: The estimated population exposure to high O3 concentrations was largely influenced by the wind condition in the study area. Especially, the condition of inland penetration of sea breeze determined significantly the distributions of the exposure in the city. Conclusions: The results of this study suggest that the estimation of population exposure to high O3 concentrations having high sensitivity on short-term exposure will be needed for considering the characterized local wind conditions in the complex coastal city to improve the uncertainty of the estimation.

Abstract Number	**P-3-04-11**
Presenter	Susan Hodgson*, Peter WW Lurz, Mark DF Shirley, Mary Bythell, Judith Rankin
Exposure	others
Health domains	reproductive outcomes
Type of research	exposure measurement

Exposure misclassification due to residential mobility during pregnancy

Background: Pregnant women are a highly mobile group, which may introduce exposure misclassification if exposure during pregnancy is assigned to place of residence at birth. The spatial and temporal variability of the exposure variable, and scale at which it is measured, are likely to influence the extent of error introduced. Aims: We investigated the impact of maternal residential mobility on exposure to a selection of environmental and socio-economic variables that varied in space and/or time. Methods: For spatially varying exposures (deprivation, urban fabric, roads and air pollution (PM10 and NO2)) we compared exposure assigned to maternal residential postcode at delivery versus conception; for exposures with temporal variability (air pollution and temperature) we also compared exposure assigned to date at delivery versus conception. We used data on residential history for deliveries recorded by the Northern Congenital Abnormality Survey, 2000-2008, (n=7432). Results: In this population, 24.4% of women moved during pregnancy. For spatially varying exposures, there was good agreement between exposures assigned to address at delivery versus conception. Nonetheless, depending on the exposure, between 1 and 9% of women overall were assigned an exposure at delivery >1SD different to that at conception. For time varying exposures, 18-63% of women were assigned an exposure at the date of delivery >1SD different to that at date of conception. Conclusions: Antenatal environmental and area-level exposures assigned to place of residence at birth may be affected by mobility during pregnancy and therefore potentially attenuate or bias risk estimates. However, the extent of the misclassification differs depending on the exposure being considered.

Abstract Number	**P-3-04-12**
Presenter	Andrea Spinazzè*, Andrea Cattaneo, Domenico Maria Cavallo
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Individual exposure to size-fractionated particulate matter and carbon monoxide in selected microenvironments of the Milan urban area

Background Human exposure in transport micro-environments (MEs) is of particular interest because many citizens and commuters spend a substantial component of their time in these spaces. Fixed monitoring stations measuring outdoor air quality are used to estimate exposure levels, however, this approach may significantly underestimate the exposure of particular population subgroups, pointing to the need for direct personal exposure measurements. Aims Ultrafine particles (UFPs), size-fractionated particulate matter (PM) and carbon monoxide (CO) were measured in the central area of Milan, in order to assess the influence of time and space on individual exposures. Methods Individual exposures to CO (passive analyser - electrochemical cell), UFPs and PM (Condensation and Optical Particle Counters) were continuously collected along an established urban pathway, moving afoot or by different private and public means of transport during three week-long periods (summer, autumn and winter) and through three sampling sessions per day. Results The analysis of the exposure measures showed statistically significant differences between different MEs and sampling periods. The highest mean concentrations were observed during time spent along busy streets (walking or moving by motorized vehicles), in metro trains and on working-day mornings; the lowest exposures were observed in green areas and in indoor environments. PM and CO showed different seasonal behaviours: the highest mean concentrations were observed in summer for CO and for the coarser fractions of PM, and in winter for the finer fractions of PM. Conclusions Appreciable differences among MEs and sampling periods were observed. Exposure patterns appeared to be mostly related to the proximity to traffic sources, to peculiarities of MEs, as well as to time periods during the day, days of the week, and seasons of the year.

Abstract Number	**P-3-04-13**
Presenter	Ilan Levy*, Noam Levin, Joel D. Schwartz, Jeremy Kark
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Inter-annual variability in national exposure estimates from land use regression models

Background: Land Use Regression (LUR) models have become a common method for estimating exposures to traffic-related air pollution. However these empirical models are usually based on short term measurement campaigns of several weeks, in some cases repeated 3-4 times at different seasons of one year. The relevance of these models to assessing chronic exposures over many years remains unclear. Aims: To examine the inter-annual variability in exposure estimates over a decade. Methods: National LUR models were developed for NO2 for all of Israel from existing air quality monitoring network (AQMN) data available between 1998-2010, with an increase from 11 to 78 in the number of sites over that time. First, a base case model was developed from the collection of the annual mean NO2 at each station and each year (N = 688). Two options were then employed for testing inter-annual variability of the LUR, using the same set of predictors: 1. calculating a separate model for each year 2. Applying the regression coefficients of the base case model to each year. Results: The base case model achieved an adjusted R2 of 0.75 (leave-one-outcross validation 0.74, p-value<0.0005, slope 0.99). The inter-annual variability in the models across 13 years (option 1), in terms of adjusted-R2, ranged between 0.52-0.73. Applying the regression coefficients of the base case to each year (option 2) yielded adjusted-R2 in the range of 0.69-0.91, an increase of ~ 8-20% in R2 for individual years, compared to the first option. No trend could be identified in inter-annual variability of the models. Conclusions: A LUR model applied separately for each year had an inter-annual variability of 21% in terms of R2. When applying regression coefficients of a base case model to each year, the variability remains about the same (23%) but the models are able to explain a larger portion of the variance.

Abstract Number	**P-3-04-14**
Presenter	Malek Bentayeb*, Morgane Stempfelet, Vérène Wagner, Marie Zins, Marcel Goldberg, Amandine Rosso, Eric Chaxel, Alexandre Armengaud, Philippe Rossello, Raphaèle Deprost, Christophe Declercq
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Long-term exposure to air pollution. a 20-year follow-up in a French cohort study.

Background: Long-term exposure to air pollution was associated to mortality in numerous recent studies. Several methods have been developed to assess air pollutants concentrations at fine spatial scale. Aims: In this work, our aim was to estimate long-term exposure to air pollution of the 20,625 participants of the French GAZEL cohort study, followed up from 1989 to 2008, by using deterministic and geostatistical methods. Methods: Levels of PM10, PM2.5, NO2, O3, SO2, and C6H6 were assessed for the whole continental France using reconstructed emissions inventories, CHIMERE chemistry-transport model for estimating concentrations at a 10 km*10 km resolution taking into account meteorological conditions. Statistical metrics such as correlation coefficient, bias and Root Mean Square Error (RMSE) have been used to assess the model and are consistent with data provided in the literature. Mesh refinement allowed us to estimate the concentrations at a 2 km*2 km resolution; data assimilation improved the spatial distribution and accuracy of pollutant concentrations. Output of the model was assigned to participants by their zip code taking into account residential history. Results: All pollutant concentrations have decreased over the study period. However, some have leveled off since 2000 (PM10, PM2.5, and O3). Median [min; max] values of the annual concentrations (µg/m3) at participants zip code in 1989, 2000 and 2008 were respectively, 26[6; 44], 21[5; 44] and 19[4; 44] for PM10, 17[4; 29], 12[2; 33] and 12[2; 21] for PM2.5, 25[2; 94], 20[2; 68] and 15[1; 41] for NO2, 102[52; 124], 86[55; 112] and 86[63; 110] for O3, 7[0,9; 58], 4[0,5; 21] and 1[0,1; 23] for SO2, 2[0,2; 8], 0,8[0,1; 3] and 0,3[0,05; 2] for C6H6. Conclusion: Retrospective exposure to air pollution was estimated for the whole continental France. These data will be used to study the impact of chronic exposure to air pollutants on long-term mortality of participants of the GAZEL cohort.

Abstract Number	**P-3-04-15**
Presenter	Aleksandra Jedynska*, Gerard Hoek, Rob Beelen, Klea Katsouyanni, Giulia Cesaroni, Helgah Makarem, Kirsten Eriksen, Timo Lanki, Christophe Declercq, Bert Brunekreef, Ingeborg Kooter
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

OXIDATIVE POTENTIAL IN 10 EUROPEAN AREAS OF THE ESCAPE STUDY: SPATIAL VARIATION AND LAND USE REGRESSION MODELS

Background:TRANSPHORM and ESCAPE are EU FP7 funded projects providing knowledge on the impact of air pollutionon human health in Europe by adding air pollution exposure assessment to health data available from European cohort studies. Oxidative potential is increasingly used as metric related to PM adverse health effects considering PM chemical complexity. Aim: The goal of the present study was assessment of PM2.5 oxidative potential levels in 10 European study areas and development of land use regression models (LUR) in order to assess exposure of cohort studies participants to oxidative potential. Methods: Oxidative potential (OP) was measured with the DTT assay in: The Netherlands, Oslo, Barcelona, Munich, Copenhagen, Helsinki, Athens, Paris, Rome, in addition to NOx, PM2.5 and PM10 (mass, absorbance), PAH's, EC/OC and metals. Three two-week samples were taken at 20–40 street , urban and regional background sites in each study areas. LUR models were developed based on annual average concentrations and various traffic and land-use related GIS-predictor variables. Results: OP level were highest in Athens (0.28nmolDTT/min*m3) and Rome, Paris, Barcelona (0.23). The lowest OP was in Oslo, London, Helsinki – 0.13, 0.14, 0.15nmolDTT/min*m3). The median ratio of at street locations compared to urban background was 1.11. The median regional to urban background OP ratio was 1.04. OP levels during different seasons differed significantly in 9 study areas. The median cold to warm season OP ratio was 1.51. Spatial OP correlations with other components varied across areas, the most consistent were found in Athens (PM2.5, PM2.5abs, OC, Zn, Ni, S). In 6 locations LUR models could be developed with the highest model explained variance (R2) in The Netherlands – 66%. The median R2 was 25%. Cross validation R2 was on average 10% lower. Conclusions: Oxidative potential levels differed across Europe. Relatively low R2 of LUR models can be explained by lack of identified sources of oxidative potential among variables used for models development.

Abstract Number	**P-3-04-16**
Presenter	Ebba Malmqvist*, Lars Modig, Annika Hagenbjörk-Gustafsson, Håkan Tinnerberg, Kristoffer Mattisson, Lars Rylander
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Ozone variation in space and time

Ozone variation in time and space Background: Air pollution exposure models are getting improved for some pollutants such as NOx. However, there are other pollutants possibly as detrimental for health, such as ozone, for which no good exposure models exist. Aim: To develop a regression model aiming at explaining variations in time and space for ozone. Method: We measured levels of ozone at 40 stations in the South of Sweden and 40 stations in the North of Sweden during spring, summer and autumn with a weekly resolution. For 3 measurement stations we collected ozone with a daily resolution. We developed two separate land use regression models for the weekly ozone measurements in the two areas. In the land use regression model we included variables from road, land cover, altitude and population databases. For the stations with a daily resolution we developed a regression model with collected meteorological variables. Results: We found a good correlation between some meteorological variables and levels of ozone. It was harder to find a good model for ozone variation in space. Results are preliminary and more results will be presented at the conference.

Abstract Number	**P-3-04-17**
Presenter	Salem Albalawi*, Susan Hodgson, Anil Namdeo, Tanja Pless-Mulloli
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Personal versus fixed-site monitoring for assessing PM2.5 exposure in an industrial city, Saudi Arabia

Background: Air pollution is a known risk factor for adverse health effects. Many epidemiological studies use outdoor air pollution levels based on fixed-site monitoring data as a surrogate for human exposure, however individuals spend, on average, 85% of their time indoors, where exposure sources differ from outdoors. Personal monitoring allows more appropriate exposure estimation, but, to date, little has been done to compare exposure based on fixed-site versus personal monitoring, and no such comparisons have been carried out in the Middle East. Aims: To investigate the validity of fixed-site versus personal monitoring of PM2.5 in an industrial city in Saudi Arabia. Methods: We collected 24-hour personal monitoring of PM2.5 exposure from 28 students aged 16-18 years, using a SidePak AM510 set to record PM2.5 levels every minute. Students completed a time-activity diary to identify time spent in key microenvironments, especially outdoors and indoors. Students also carried a GPS device to log their geographic position. Hourly ambient PM2.5 levels for the same 24 hour periods were extracted for the nearest fixed-site monitoring station. The GPS data and home locations are being used to plot the geographic distribution of residuals in GIS to explore the spatial variation in the fixed versus personal monitor data. Results: Hourly mean PM2.5 exposures were higher when assessed via personal monitoring (Mean=39.3 µg/m3, Median=30.5, SD=52.2, Range=816.3) than fixed-site monitoring (Mean=20.4, Median=12.2, µg/m3, SD=27.1, Range=257.6). There was a non-significant correlation between log transformed personal and fixed-site monitor PM2.5 levels when subjects were predominantly outdoors (Correlation=0.31, p=0.07, n=39hrs), and a weak, but significant correlation when subjects were indoors (Correlation=0.14, p<0.00, n=605hrs). Conclusion: The validity of fixed site air monitoring data as a proxy for personal exposure to PM needs to be characterised so that the exposure error associated with this proxy measure is better understood.

Abstract Number	**P-3-04-18**
Presenter	Dolores Catelan*, Ana M. Vicedo-Cabrera, Laura Grisotto, Fabio Barbone, Annibale Biggeri
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Predicting personal exposure to air pollutants in children living in a high risk area. A Universal Bayesian Kriging approach.

Background: A core challenge in epidemiological analysis of the impact of air pollution exposure on health is assigning exposures to individuals subjects at risk.GIS-based (Geographical Information Systems) pollution mapping has become one of the main tools for exposure assessment to ambient pollutants, which interpolation techniques, such as Kriging, have helped to utilize routine monitoring data to estimate levels of ambient air pollutants at unmeasured locations. Aim:to estimate the individual exposure to gaseous air pollutants of asthmatic children living in the area of Milazzo-Valle del Mela (Sicily, Italy) by Universal Bayesian Kriging approach. Methods:Weekly measurements for sulphur dioxide (SO2) and nitrogen dioxide (NO2)were obtained from 21 passive dosimeters located at each school yards of the study area (November 2007-April 2008). The residences of 113 asthmatic children were geo-referenced. A Universal Bayesian Kriging approach was performed to predict individual exposure levels at each residential address, using as covariates land use information, altitude, distance to main roads and population density. Results: A large geographical heterogeneity in air quality was recorded suggesting complex exposure patterns. With an effective sample size of, we obtained a predicted mean level of 25.78 (± 10.61) µg/m3 NO2 and 4.10 (± 2.71) µg/m3 SO2 at 1,682 children's residential addresses, with a normalized root squared mean of 28% and 25%, respectively. The spatio-temporal distribution of SO2 concentrations showed a point source effect with a plume consistent with prevalent winds, whereas NO2 patterns were more stable and reflected mostly diffuse traffic emissions. Conclusion: Universal Bayesian kriging may be useful to predict residential concentrations from monitoring data. Heterogeneity of the spatio-temporal distribution of pollutants should be considered in order to estimate the real exposure to them.

Abstract Number	**P-3-04-19**
Presenter	Colleen Reid*, Michael Jerrett, Ira Tager, Maya Petersen, Philip Morefield, John R. Balmes
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Spatiotemporal modeling of wildfire smoke exposure in Northern California using satellite data and chemical transport models

Background: Estimating population exposure to smoke from wildfires is difficult due to the lack of dense monitoring networks in the rural areas where wildfires most often occur. Chemical transport models and satellite retrievals provide spatiotemporal data that may be useful in predicting PM2.5 during wildfires in areas where monitoring networks are not available. California's relatively dense air monitoring network provides an opportunity to build and validate such prediction models.Aims: We sought to predict population exposures to PM2.5 from a combination of spatiotemporal exposure data for the 2008 Northern California wildfires and to evaluate the performance of these predictions.Methods: We used 10-fold cross validation (CV) to choose the optimal exposure model from a set of 11 different statistical models and 31 predictor variables, including output from the WRF-Chem model, MODIS AOD (aerosol optical depth), GASP AOD, and a high-resolution AOD estimate derived specifically for this fire from raw MODIS data. Models were compared based on the CV root mean squared error (RMSE) and R2. The best models were evaluated for lack of spatial autocorrelation in the residuals and by visual inspection that predicted values captured by the spatiotemporal characteristics of the wildfire plume based on satellite visible imagery. Results: The three AOD measures were highly correlated with each other and GASP AOD had the highest correlation with PM2.5 monitoring data. A generalized boosting model with 29 covariates, including the 3 AOD measures, the WRF-Chem output, meteorological variables, and spatial and temporal information provided the best prediction of monitoring data, with a CV R2 of 0.78. The best individual predictor, GASP AOD, explained 42% of the variability in the monitoring data.Conclusions: Combining various spatiotemporal data in machine learning algorithms reliably predicted PM2.5 exposures during a wildfire event.

Abstract Number	**P-3-04-20**
Presenter	Harish C. Phuleria*, Ming-Yi Tsai, Martina S. Ragettli, Elisabetta Corradi, Alex Ineichen, Thierry Rochat, Nicole Probst-Hensch, Martin Fierz, Nino Kuenzli
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

SPATIOTEMPORAL VARIATION OF PARTICLE NUMBER AND SURFACE AREA CONCENTRATION IN FOUR SWISS AREAS AND ITS RELATIONSHIP WITH MASS MEASUREMENTS

Background: This study is part of the Swiss Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA), a cohort study initiated in 1990 and spread across eight geographically diverse areas in Switzerland. Innovative exposure modeling has been conducted in SAPALDIA earlier for PM10 and NO2, however, exposure to specific traffic related pollutants such as ultrafine particles and PM constituents has not been assessed. Aims:The overarching aim is to provide the estimates of individual long-term outdoor traffic-related air pollution exposures of the cohort participants. This paper focuses on the spatial and temporal variation of home outdoor particle number (PN) and lung-deposited surface area (LDSA) concentration in four study areas: Basel, Geneva, Lugano and Wald. Methods: Weekly outdoor PN and LDSA are measured at 20 residences each in four study areas in three seasons over a period of 2 years, 2011-2012. PN and LDSA are measured using a portable particle counter, miniDiSC (miniature diffusion size classifier). It is a portable diffusion charging based device and measures nanometer sized (10-300nm) particles with a time-resolution of one second. Results: Mean weekly outdoor PN levels aggregated across all seasons and sites are 11000±3700, 15400±8430 and 15700±7200 particles/cm3 in Basel, Geneva and Lugano, respectively. As expected, PN are highest in winter and lowest in summer for all study areas/sites. PN levels show a clear morning and evening rush hour in all seasons in all sites, but more prominently at street sites. PN shows reasonably moderate correlation with NO2 but poor to no correlation with other PM mass metrics in all seasons. Analysis of LDSA measurements and comparison with PN and other pollutants is currently underway. Conclusions: Our results show significant seasonal and spatial variation in home outdoor PN levels within and between study areas and document the differential impact of traffic on PN levels in all study areas.

Abstract Number	**P-3-04-21**
Presenter	Michael J. Gatari Gichuru*, Jeremiahj K. Ngenoh, David M. Maina, Lydia W. Njenga
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Traffic and mineral dust impact on air quality in Nairobi, Kenya

Air quality issues remain a challenge in major cities of Sub-Saharan Africa and Nairobi, the capital city of Kenya, is no exception. However, there has been many short study campaigns assessing both ground level, about 1.5 m above ground level (agl) and at regional air mass heights above 10 m agl. None of the studies addressed measurements at both heights simultaneously until the study by Kinney et al. (2010). This study was focused on traffic influence in the Central District (CBD) of Nairobi and it showed concentrations of PM2.5 remained high but attenuated in the vertical profile to heights above 17 m agl. There were no obvious implications of regional air mass influence in the CBD measurement during that regional winter of 2009. The current short study revealed a marked influence by regional air mass at an urban site where mineral dust elements at heights above 17 m agl were higher than those measured at 1.5 m agl simultaneously. The measurements were for 8 hours a day at an industrial and urban site during the regional summer of 2012. The study included manual counting of vehicles, filtered PM2.5 particles and subsequent trace element analysis using EDXRF at the university of Nairobi. At the urban site average concentrations of PM2.5 were 73 µg m-3 at 17 m agl and 48 at 1.5 m, and the vehicle count was 442 h-1. Mineral dust elements of Ca, Ti and Fe were 11.5, 2.3 and 29.1 µg m-3 respectively at 17 m agl and 6.7, 2.8 and 20.5 at 1.5 m. At the industrial site PM2.5 values were 47 at 14 m agl and 71 at 1.5 while Ca, Ti and Fe registered 8.1, 2.3 and 19.8 µg m-3 respectively at 14 m agl and 6.4, 1.8 and 16.1 at 1.5 m. The average number of vehicles was 335 h-1. These results showed clear influence of regional air mass on air quality in Nairobi. They also indicated the ground level pollutants are impacted more by the type of vehicles than numbers. The vehicles transiting the industrial site were mainly heavy-duty trucks and lorries while saloon vehicles transited the urban site. Most trucks and lorries have diesel engines while saloon vehicles have mainly petrol engines.

Abstract Number	**P-3-04-22**
Presenter	Peter Molnar*, Leo Stockfelt, Annika Rosengren, Lars Barregård, Gerd Sallsten
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Trends in NOx exposure contrast from 1975 to 2004 in the Gothenburg Primary Prevention Study cohort

Background and aims: It is well known that air pollution from combustion processes causes morbidity and mortality from cardiovascular and pulmonary diseases. Nitrogen oxides (NOx) are commonly used as markers for these pollutants. The Primary Preventive Study is a cohort of 7494 men in Gothenburg born 1915-1925 who were enrolled and underwent medical examination and identification of risk factors 1970-1973. The aims were to estimate exposure levels and contrasts in the cohort. Methods: NOx levels were modelled for the years 1975 and 2004 based on the emission inventory database and traffic records. The Enviman AQPlanner (OPSIS, Sweden) was used, consisting of a street canyon model, OSPM (DMU, Denmark) and a Gaussian model, AERMOD (US EPA). Mean levels are available in 50x50 m grid cells.From the Swedish Bureau of Statistics (SCB) and the National Archives, annual home addresses of all volunteers were collected and geocoded.The levels of NOx at the home addresses for the members in the PPS cohort have been estimated for the years 1975 and 2004. Results: In 1975, 6725 subjects were still alive and residing in the Gothenburg area. 5960 home addresses (89%) were geocoded with good quality. The rest were living outside the modelled area or could not be geocoded with sufficient accuracy. In 1975, the mean NOx level was 44 µgm-3, and the means for the lowest and highest quartiles 20 and 73 µgm-3. In 2004, the mean NOx level had decreased to 24 µgm-3 and the corresponding quartile means were 14 and 35 µgm-3. The reduction of NOx levels was on average 46% (29% and 52% in the lowest and highest quartiles, respectively). The contrast (ratio) between high and low exposure quartiles was 3.7 in 1975 and 2.5 in 2004. Conclusions: There was a relatively large contrastbetween low and high exposure levels in this cohort. The reduction in NOx levels was highest among the high exposure homes, leading to diminishing contrasts between different locations in the city.

Abstract Number	**P-3-04-23**
Presenter	Audrius Dedele*, Regina Grazuleviciene, Tomas Grazulevicius, Aukse Miskinyte
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Use of ADMS-Urban dispersion model to estimate the concentration of nitrogen dioxide in Kaunas city

Background Modelling of air pollution dispersion is one of the ambient air quality assessment methods, allowing predicting air pollution and accurately assessing the spatial distribution of ambient pollutants in the city.However, the estimation of the spatial variation of the nitrogen dioxide (NO2)using ADMS-Urban model has not been evaluated extensively. Aims The purpose of this study was to evaluate the fitness of ADMS-Urban dispersion model to determine dispersion of NO2 concentrations for exposure estimation in epidemiological studies. Methods In 2011 year, using Ogawa passive samplers we monitored NO2 concentration and modelled annual average concentrations for winter, summer and intermediate seasons in Kaunas city. NO2 concentrations estimated by ADMS-Urban model have been verified from 41 Ogawa passive samplers monitoring place results. Results The modelling results showed that the highest mean seasonal NO2 concentration was in winter (21,79 µg/m3), and the lowest was in summer (12,28 µg/m3). Correlation coefficient between concentrations of NO2 modelled using ADMS-Urban model and measured by Ogawa passive samplers was high for all seasons (from R2=0,727 to R2=0,793). Conclusions Our results confirmed the generally good performance of the ADMS-Urban model for the spatial distribution of NO2concentrationsin the city.

Abstract Number	**P-3-05-01**
Presenter	Ludmilla Jacobson*, Sandra Hacon, Eliane Ignotti, Hermano Castro, Paulo Artaxo, Paulo Hilário Saldiva, Antonio Ponce de Leon
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Acute effects of particulate matter and black carbon on peak expiratory flow in a panel of schoolchildren residents in Tangará da Serra, Brazilian Amazon.

Background: Panel studies have revealed adverse effects of air pollution on children's health due to biomass burning. The Brazilian Amazon has been marked by regular forest fires in the dry season during which high concentrations of air pollutants are frequent and long-lasting. Aim: To estimate the effect of current levels of air pollution in the Amazonian dry season on Peak Expiratory Flow (PEF). Methods: Panel study with 234 schoolchildren aged 6 to 15 years, living in the municipality of Tangará da Serra, Mato Grosso State, Brazil. PEF was measured daily in the dry season of 2008. Excluding weekends and holidays, the total number of study days was 53. All together there were 11198 PEF measures. Mixed effect models and a unified model approach repeated for every child were applied. Both model approaches regarded time trend, temperature, humidity, and subject characteristics. Inhalable particulate matter (PM10), fine particulate matter (PM2.5), and Black Carbon (BC) effects were estimated considering the 24-hour exposure lagged by 1 to 5 days and the averages of 2 or 3 consecutive days. Polynomial distributed lag models (PDLM) were also applied. Results: The analyses pointed to reductions on PEF for increases of 10 units of pollutants. For PM10, the reductions varied from 0.15 (CI95%: -0.29; -0.01) to 0.25 l/min (CI95%: -0.40; -0.10). For PM2.5, they ranged from 0.46 (CI95%: -0.86 to -0.06) to 0.54 l/min (CI95%:-0.95; -0.14). As for BC, the reduction was about 0.014 l/min. As regards PDLM, adverse effects were obtained for the current day until 5 past days. The sum of effects for PM10, corresponded to a PEF reduction of 0.31 l/min (CI95%: -0.56; -0.05). These associations were stronger for children between 6 and 8 years old. Conclusion: Reductions on PEF were associated with air pollution, mainly for lagged exposures of 3 to 5 days and for younger children.

Abstract Number	**P-3-05-02**
Presenter	Mohammad Vossoughi*, Tamara Schikowski, Andrea Vierkötter, Barbara Hoffmann, Tom Teichert, Christian Herder, Thomas Schulte, Christian Luckhaus, Monika Raulf-Heimsoth, Dorothea Sugiri
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Air pollution and subclinical inflammation in the lung: direct or indirect effect? Results from the SALIA cohort study

Background: Pulmonary inflammation is considered a first step in the induction of adverse health effects from air pollution. More than 20 years ago it could be demonstrated in women from the baseline investigation of the SALIA cohort that air pollution was associated with lung function impairment and COPD, which usually is associated with inflammatory processes. We determined markers of pulmonary inflammation in a follow-up examination of the SALIA cohort after a considerable decline in air pollution. Aims: We aimed to determine the direct effect of current exposure to particulate matter from traffic and industry on inflammatory markers in the lung. Indirect effects mediated by a long lasting deterioration of lung function should be excluded. Methods: In the baseline (1985-1994) and in the follow-up (2008) examinations of SALIA 402 women were clinically investigated. Inflammatory markers in exhaled breath condensate and in induced sputum (i.e. NO-derivatives, cell counts, leukotrienes) were measured in 2008 and lung function (FEV1) was determined at baseline and in 2008. Individually modelled air pollution exposures at baseline and follow-up were determined within the ESCAPE project. The effect of pollution on inflammatory markers was considered direct if inclusion of the lung function did not alter the linear regression results adjusted for age, smoking, BMI, height, socio-economic status and presence of indoor mould.. Results: Air pollution and lung function at baseline were highly correlated with their values at follow-up. A one litre decrease in baseline FEV1 was associated with a 19.5% (95% CI: -3.6%-37.4%) increase of NO-derivatives at follow-up. An interquartile increase in current PM2.5 was associated with a 16.2% (95% CI: 1.1%-33.5%) higher NO-derivatives in sputum. However adjustment for lung function at baseline changed this parameter estimate from 16.2% to 16.4% only. Conclusions: The effect of air pollution on inflammatory markers might be a direct effect. We did not find evidence for a mediation of effect by deteriorated lung function.

Abstract Number	**P-3-05-03**
Presenter	Xiaohui Xu*, Hui Hu
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Ambient Air Pollution and Hypertensive Disorders of Pregnancy in Jacksonville, Florida

Background: Evidence on the association between air pollution and hypertensive disorders of pregnancy (HPD: hypertension developed after 20 weeks of pregnancy with or without proteinuria) is very limited and time of window of exposure to air pollution during pregnancy on HDP has not been well studied. Aims and Methods:We used the Florida birth registry data to investigate the associations between air pollutants (NO2, SO2, PM2.5, PM10, O3, and CO) and the risks of HDP among 21,843 pregnant women in Jacksonville, Florida from 2004 to 2005. Further, we examined whether air pollution exposure during different time of window defined by trimesters and the entire pregnancy had different effects on HDP. Results: Results from the single-pollutant logistic regression model show that exposure to NO2 (OR=1.14, 95%CI: 1.03-1.26), PM2.5 (OR=1.25, 95%CI: 1.09-1.43), SO2 (OR=1.13, 95%CI: 1.02-1.26), and CO(OR=1.10, 95%CI: 1.01-1.19) during the full pregnancy period was significantly associated with development of HDP after adjusting for covariates. This effect was even more pronounced when the first trimester exposures to NO2, SO2, and CO, and the second trimester exposures to PM2.5 were examined. Similar results were observed in two-pollutant models. Conclusions: This study suggests that exposure to high levels of air pollution during pregnancy, especially during early pregnancy, may have deleterious effects on the development of HDP. The findings from this study warrant further investigation.

Abstract Number	**P-3-05-04**
Presenter	Nina Zaitseva, Pavel Shur*, Vadim Alekseev
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Assessing the impact of ambient air pollution by cresol and phenol on disease incidence in children

Background / Aims: The areas influenced by electrical engineering companies are characterized by ambient air pollution typically including cresol and phenol. The aim of the study was to investigate disease incidence in children, who were chronically exposed to cresol and phenol. The average daily concentrations of cresol and phenol in ambient air were found to be 0.04 mg/m3 and 0.013 mg/m3, respectively. The performed health risk assessment determined hazard quotients for chronic exposure to cresol and phenol 10.0 and 2.1, respectively. Methods: Disease incidence in children aged 3-7 years (n=127), residing in the area influenced by the emissions from a cable producing company, and in a control group (n=88) was investigated based on outpatient visits during a one-year period and based on a special medical examination. The levels of n-, m-, o-cresols in the blood were determined using gas chromatography. Results: The study group children demonstrated higher concentrations of n-, m-, o-cresols in their blood (0.560±0.120) mg/dm3 in comparison with the control group (0.179±0.036 mg/dm3). Based on the odds ratio, we determined a relationship between chronic exposure to cresol and phenol and the incidence of vasomotor rhinitis (OR=8.85, CI 3.64 to 21.53), asthma (OR=2.07, CI 1.14 to 3.76), diseases of blood and blood-forming organs and immune disorders involving the immune mechanism (OR=1.56, CI 1.06 to 2.29), diseases of the nervous system (OR=3.34, CI 2.46 to 4.53). The performed medical examination confirmed the relationship between exposure to cresol and phenol and vasomotor rhinitis (OR=3.00, CI 1.71 to 5.26) and blood disorders (OR=2.56, CI 1.05 to 6.26), but identified no relationship between exposure and asthma and diseases of the nervous system. The assessment of the impact of air pollution by cresol and phenol revealed the relationship between the incidence of vasomotor rhinitis, asthma, diseases of blood and the nervous system and exposure to cresol and phenol, which coincides with the results of the health risk assessment.

Abstract Number	**P-3-05-05**
Presenter	Janine Whichmann*, Annika Rosengren, Karin Sjöberg, Lars Barregård, Gerd Sallsten
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Association between ambient temperature and acute myocardial infarction hospitalisations in Gothenburg, Sweden: 1985-2010

Background: Cardiovascular disease (CVD) is the number one cause of death globally and evidence is steadily increasing on the role of non-traditional risk factors such as meteorology and air pollution. Nevertheless, many research gaps remain, such as the association between these non-traditional risk factors and subtypes of CVD, e.g. acute myocardial infarction (AMI). Aims:To investigate the association between daily ambient temperature and AMI hospitalisations in Gothenburg, Sweden (1985-2010). Methods: A case-crossover epidemiological study design was applied. Confounding by PM10, NO2, NOx and O3 was investigated. Susceptible groups by age and sex were explored. The entire year as well as warm (April-September) and cold periods (October -March) were considered. Results:In total 28 215 AMI hospitalisations (of 22 475 people) occurred during the 26-year study period. A linear exposure-response corresponding to a 3-7% decrease in AMI hospitalisations was observed for an inter-quartile range (IQR) increase in the 2-day cumulative average of temperature during the entire year (11 °C) or the warm period (6 °C), with and without adjustment for PM10, NO2, NOx or O3. No heat waves occurred during the warm period. No evidence of an association in the cold period was observed. No susceptible groups, based on age or sex, were identified either. Conclusions: An inverse association between temperature and AMI hospitalisations (entire year and warm period) was found in Gothenburg, and this is in accordance with the majority of the few other studies that investigated this subtype of CVD. Tentative mechanisms include physiological (less vasoconstriction) and psychosocial (general well-being) factors associated with a warmer climate (without heat waves).

Abstract Number	**P-3-05-06**
Presenter	Regina Hampel*, Annette Peters, Rob Beelen, Kateryna Fuks, Johanna Penell, Nicole Probst-Hensch, Timo Lanki
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	meta-analysis

Association between long-term exposure to particulate matter constituents and blood markers of inflammation in European cohorts.

Background. Epidemiological studies have shown long-term effects of particulate matter (PM) on cardiovascular mortality. However, studies investigating the effects of PM and especially its constituents on systemic inflammation, a cardiovascular risk factor, are rare. Aim. To investigate the association between long-term exposure to chemical PM components and the inflammatory blood markers C-reactive protein (CRP) and fibrinogen as part of the ESCAPE (European Study of Cohorts for Air Pollution Effects) and TRANSPHORM projects. Methods. In total, 21,558 CRP and 17,428 fibrinogen measurements were available from five and four cohorts, respectively. Residential long-term concentrations of PM<10µm (PM10) and <2.5µm (PM2.5) and their constituents were estimated with land-use regression models. Component effects were estimated using linear regression models with and without adjustment for total PM for each cohort separately. Cohort-specific results were combined using random effects meta-analysis. Results. Pooled PM2.5 (2.4% [95%-confidence interval:-7.5;13.4%] per 5µg/m³ increase) and PM10 (1.2% [-3.8;6.4%] per 10µg/m³ increase) effects on CRP were non-significant. However, a 5ng/m³ increase in PM2.5 copper led to an increase in CRP of 6.3% [0.7;12.3%]. Moreover, a 500ng/m³ increase in PM10 iron was associated with a 3.6% [0.3;7.1%] increase in CRP. The component effects remained similar when adjusting for total PM. Cohort-specific mean PM2.5 copper and PM10 iron levels ranged between 1.7 and 5.9ng/m³ and between 274 and 779ng/m³, respectively. The two components showed a moderate to high correlation. We observed no effects of potassium, nitrate, sulfur, silicon, vanadium, and zinc. Pooled component effects on fibrinogen were weaker and mostly not significant partly because of heterogeneity between the cohorts. Conclusion. Long-term exposure to the PM constituents copper and iron may induce chronic systemic inflammation possibly leading to adverse cardiovascular events.

Abstract Number	**P-3-05-07**
Presenter	Getahun Bero Bedada*, Raymond Agius, John New, Martin Gibson, Roseanne Mcnamee, Adrian Hirst, Kirk Siddals
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Associations between personal and ambient air pollution and markers of inflammation, thrombosis and endothelial function in diabetic patients

Background and Aim: It has been suggested that diabetics are particularly susceptible to the effects of air pollutants. The aim of the study was to investigate the effect of air pollutants on markers of systemic inflammation, thrombosis and endothelial function as intermediate health outcomes in a vulnerable type 2 diabetes mellitus population. Method: The study consisted of 32 subjects with type 2 diabetes mellitus from Salford district, North West England who were prospectively followed. At each visit blood was collected to measure interleukin-6 (IL-6), high-sensitivity C-reactive protein (hs-CRP), fibrinogen, D-dimer, E-selectin, ICAM and vWF. Data on ambient PM10 and gaseous pollutants were obtained from a fixed central site monitor and PM2.5 was measured by personal monitors. Effects were investigated by linear mixed models with random intercepts for each subject and by adjusting for age, gender, BMI, smoking history, temperature and relative humidity. Results: The study included 22 male and 10 female subjects out of which 28 completed all four visits. Participants were current non-smokers with the age range of 48 to 78 years. We observed a 12.7 % (95% CI: 1.3 to 25.3%) increase in IL-6 in association with an interquartile range increase in personal PM2.5 exposure. We also found large, but non-significant associations between personal PM2.5 and hs-CRP and fibrinogen. No consistent association was observed between measured biomarkers and air pollutants obtained from the central monitoring stations. Conclusions: The study demonstrates a significant association between personal exposure to PM2.5 and IL-6 and this provides evidence for the link between ambient air pollutants and inflammatory markers. The absence of association with ambient air pollutants may be due to exposure misclassification. The findings highlight that measurements of personal exposure to airborne pollution show a better association with inflammatory markers than those based on centrally located fixed monitors.

Abstract Number	**P-3-05-08**
Presenter	Amar Mehta*, Antonella Zanobetti, Petros Koutrakis, Murray A. Mittleman, David Sparrow, Pantel S. Vokonas, Joel D. Schwartz
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Associations between Short-term Changes in Air Pollution and Correlates of Arterial Stiffness: the VA Normative Aging Study

Background: Few observational studies have evaluated changes in arterial stiffness after short-term exposure to air pollution. Aims: We investigated associations between short-term changes in air pollution and central augmentation index (AIx) and augmentation pressure (AP), correlates of arterial stiffness, in a cohort of elderly men in the Boston metropolitan area. Methods: This longitudinal analysis included 378 participants from the VA Normative Aging Study with up to two visits between 2007 and 2011. AIx (%) and AP (mmHg) were measured at each visit using radial artery applanation tonometry for pulse wave analysis, and modeled in a mixed effect regression as continuous functions of moving average (4h, 24h, 2 to 14 days) of air pollution exposures. All models were adjusted for age, body mass index, high density lipoprotein cholesterol level, education, race, alcohol consumption, smoking status, cumulative pack-years smoked, diabetes status, seasonality, day of week, and corresponding moving average of absolute temperature and relative humidity. Results: Statistically significant ($p<0.05$) positive associations were observed between exposure to sulfate (SO42-) and fine particles (PM2.5), and particle number counts (PNC), and AIx for several moving averages. Interquartile range increases in 2-day average SO42- (1.6 µg/m3 increase) and PM2.5 (3.8 µg/m3 increase), and 11-day average PNC (7,354 counts/cm3), were associated with 0.7% (95%CI: 0.1-1.2%), 0.9% (95%CI: 0.3-1.5%), and 2.6% (95%CI: 1.2-4.1%) higher AIx, respectively. Overall, the findings were very similar for AP. Conclusions: Short-term changes in air pollution were associated with correlates of arterial stiffness in this study sample of predominantly elderly white men. The findings support the hypothesis for the role of vascular function in the cardiovascular health effects of air pollution.

Abstract Number	**P-3-05-09**
Presenter	Eric Roberts, Michelle Wong, Bahar Kumar, Alexa Wilkie, Gala King, Max Richardson*, Craig Wolff, Liang Guo
Exposure	no exposure
Health domains	cancer
Type of research	others

California Breast Cancer Mapping Project: Engaging stakeholders in developing and implementing a protocol for mapping breast cancer

Background and Aims: California is home to an engaged network of breast cancer stakeholders that need sub-county data to identify and support at-risk communities. Cancer registries are requested to produce maps depicting sub-county breast cancer incidence data, but reliance on traditional statistical tools confines them to producing county-level maps. The California Breast Cancer Mapping Project was formed to develop a protocol for mapping breast cancer rates in a manner that is useful to breast cancer stakeholders. Methods: We convened an Advisory Group (AG) of breast cancer stakeholders to elicit priorities, and characteristics for a proactive sub-county breast cancer mapping protocol. Strategies for facilitating transparent, informed, and productive decision-making included trainings to establish common vocabulary; web tools for hands-on demonstration of statistical methods; discussions to translate AG priorities into a mapping protocol and communication products; flexibility to redirect project goals; and staff commitment to prioritize and incorporate AG input. Results and Conclusions: The AG identified a protocol which was applied to nine years of data describing invasive breast cancer in California. Priorities included avoiding false positive findings, maintaining scientific credibility, and including demographic and clinical characteristics. The resulting protocol successfully identified unknown areas with elevated breast cancer risk in California irrespective of county boundaries. With AG guidance, we developed and disseminated communication materials describing the mapping results. The results and communication products will aid stakeholders to identify vulnerable communities, target resources and services, and ground discussions about social and environmental contributions to breast cancer with reliable geographic data.

Abstract Number	**P-3-05-10**
Presenter	Pietro Comba*, Paolo Ricci, Ivano Iavarone, Roberta Pirastu, Carlotta Buzzoni, Mario Fusco, Stefano Ferretti, Emanuele Crocetti
Exposure	others
Health domains	cancer
Type of research	health impact assessment

Cancer incidence in Italian Polluted Sites

Background Cancer incidence is of interest when studying the health impact of sites contaminated by chemical carcinogens, as most areas in SENTIERI Project are. SENTIERI studied mortality in sites of national interest for environmental remediation (Italian Polluted Sites-IPSs).Incidence data,in comparison with mortality,have better diagnostic quality,are not influenced by survival factors and allow the study of non-fatal and rare neoplasms Aim To examine cancer incidence in residents in IPSs included in SENTIERI Project. The study is a joint effort of the Italian Health Institute (ISS) and the Italian Association of Cancer Registries (AIRTUM-www.registri-tumori.it) Methods 22 IPSs (148 municipalities,2 millions residents) out of 44 (298 municipalities) included in SENTIERI Project are served by a AIRTUM network Cancer Register (CR). Standardized incidence ratios (SIR) and 90% Confidence Intervals (90% CI) were calculated (1996-2005) for 37 cancer sites (single or grouped). Expected number of cases in each polluted site was estimated by applying incidence rates of pool of Italian CRs Results In all IPSs combined an increased incidence for all cancer sites among males (SIR 1.05, 90% CI 1.04-1.05) and females (SIR 1.03, 1.02-1.04) was detected.Increased risks in both genders were also observed for oesophageal (males: SIR 1.15,1.08-1.24; females SIR 1.18, 1.04-1.34), liver (males: SIR 1.47,1.42-1.52; females SIR 1.18,1.38-1.51), gallbladder (males: SIR 1.12,1.04-1.21; females SIR 1.18,1.04-1.18), lung (males: SIR 1.06,1.04-1.08; females SIR 1.18, 1.10-1.18), bladder (males: SIR 1.09,1.07-1.12; females SIR 1.17, 1.11-1.24) and central nervous system (males: SIR 1.10,1.04-1.17; females SIR 1.07,1.01-1.15) neoplasms Conclusions The incidence results adds to the mortality study confirming that living in IPSs adversely affects health status of residents. In some IPSs the increased incidence is coherent with the a priori evidence evaluation completed in SENTIERI Project

Abstract Number	**P-3-05-11**
Presenter	Steven J. Lippmann*, Karin Yeatts, Lauren Thie, Adel Hanna, Anna E. Waller
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Climate Change Impacts of Ozone on Morbidity in Vulnerable Populations across the Life Stages in 2050, Mecklenburg County, North Carolina, USA

Background: Climate- and emissions-related changes in ozone concentrations will likely impact both morbidity and mortality; these changes may have greater effects on vulnerable populations such as children and older adults. Aims: 1) Estimate the climate- and emissions-related impacts on ozone-related cardiopulmonary morbidity burden from 2006-2011 to 2048-2050 in Mecklenburg County, North Carolina (NC), an urban county in Southeastern United States with over 900,000 residents. 2) Assess the sensitivity of results to alternate population growth and age structure scenarios. Methods: We obtained respiratory and cardiovascular emergency department (ED) visit data from Mecklenburg County for April-October 2006-2011 from the NC Disease Event Tracking and Epidemiologic Collection Tool surveillance system. We estimate baseline ozone-morbidity associations with a time-series model of merged daily ozone monitor data and ED visit counts. We generate projected ozone concentration grids (12km) for 2048-2050 with the Community Multi-scale Air Quality (CMAQ) chemistry transport model using the IPCC A1B emissions scenario and assuming emission changes from anthropogenic sources only . We use a health impact assessment framework to estimate the projected changes in ED visits and the influence of alternate demographic scenarios in 2050. Results: 39,515 eligible ED visits (19,812 cardiovascular, 19,703 respiratory) occurred during the 2006-2011 baseline study period, with mean daily count of 31.5 (SD 7.6). Daily maximum 8-hour average ozone concentrations ranged from 3 to 127 ppb, with median of 51 ppb; May-August 2050 ozone projections indicate decreasing ozone levels, with a median of 36 ppb and range of 18-62 ppb. Baseline associations, projected health impacts, and sensitivity to alternate demographic scenarios will be presented. Conclusions: Climate change, air quality regulation, and population dynamics will likely alter future demand for ED services. These projections can be used to inform local public health preparedness and support continued air pollution mitigation.

Abstract Number	**P-3-05-12**
Presenter	Vizuete William*, Jose Zavalas, Ken Sexton, Ilona Jaspers, harvey Jeffries
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Development of an Aerosol Sampler for In Vitro Exposure Studies of Lung Tissue

< Studying the toxicity of particulate matter (PM) through controlled in vivo exposure studies of both human and animals is costly and ethically concerning. Alternatively, in vitro studies, which are relatively inexpensive, use biological tissues as a surrogate for a biological response allowing for rapid screening of pollutants and genetic sensitivity testing. A major limitation of conventional in vitro methods is its difficulty of exposing cells in a manner that emulates in vivo exposures of pollutants directly from the air. Conventional in vitro exposure methods do not properly emulate in vivo exposures and the few commercial exposure systems available lack the efficiency needed to capture airborne particles of all sizes. A new in vitro system that uses electrostatics to deposit particles onto the cells at the air-liquid interface (ALI) has been developed. Exposure of cells at ALI is the most realistic in vitro approach to emulate in vivo exposures. The new system, named the Gillings Sampler, provides a viable environment within its electric field for cultured human lung cells grown on permeable membrane supports. Efficiencies of 45.82% and 38.72% were calculated when using custom-designed 6-well and 9-well deposition plates as part of the Gillings Sampler, which is much higher than simple diffusion and sedimentation. Microscopy and imaging techniques were used to verify that particle deposition occurs on the tissue culture plate inserts. This system enables an efficient and effective way to expose cells to particles without prior collection and subsequent resuspension in a liquid medium. The portability of the Gillings Sampler allows future in vitro studies to be conducted in both laboratory and field settings.

Abstract Number	**P-3-05-13**
Presenter	Konstantina Dimakopoulou*, Evangelia Samoli, Rob Beelen, Ole Raaschou-Nielsen, Zorana Jovanovic Andersen, Paolo Vineis, Wei Xun, Gerard Hoek, Klea Katsouyanni
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Effects of long-term exposure to air pollution on respiratory mortality; results of the ESCAPE Project.

Background: Several studies have provided evidence that chronic exposure to traffic-related air pollution, as indicated by NOx and particulate matter (PM) concentrations, has an adverse effect on health. Aims: The present study aims to investigate the relationship of long term exposure to air pollution and respiratory mortality. Methods: Data from 16 ongoing cohort studies spread over Europe were used to investigate the association between long-term exposure to air pollution and respiratory mortality within the ESCAPE project. Respiratory mortality was defined as ICD-9 codes 460 – 519 or ICD-10 codes J00 – J99. Air pollution exposure was estimated by Land Use Regression (LUR) models at the baseline residential addresses of study participants, following a standardized procedure. We used cohort-specific hazard ratios (HRs) to perform meta-analyses and derive pooled estimates for the associations between air pollutants and respiratory mortality. Results: The total number of participants was approximate 376,965, among which 1,447 were respiratory deaths. The HR and corresponding 95% confidence intervals (CI) for a 20µg/m3 increase in NOX was 1.03 (0.94 - 1.11) and for 5,000 motor vehicles/day of traffic intensity on the nearest road was 1.02 (0.94 - 1.09). There was no indication of associations between other analyzed exposures and respiratory mortality. Conclusions: The present study does not report any statistically significant associations, but may suggest that long-term exposure to traffic-related air pollution may have an effect on respiratory mortality.

Abstract Number	**P-3-05-14**
Presenter	Chi Hsien Chen*, Yuo Leon Guo
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Effects of particulate air pollution and ozone on lung function in non-asthmatic schoolchildren.

Background: Air pollution has been associated with adverse effect on respiratory health. Study results on its lung function effect were still inconsistent. Aims: This study aims to assess the relationship between ambient air pollution and lung function in schoolchildren.Method: Between April to May 2011, we conducted a cross-sectional study on schoolchildren aged 6~15 years of 44 schools in Taiwan. Adequate spirograms were obtained from 1494 non-asthmatic children. Measurements of air pollution were retrieved from air monitoring stations located within 1 km from the schools. Means levels of 24 hours daily averages in 1st-lag-day, 2nd-lag-day, and past-3-month-average were used. Two-level hierarchical linear models were fitted for individual lung function with air pollution at school levels, and adjusted for demographics, indoor exposures, outdoor activity, and co-pollutants. Result: After adjustment, the lung function changes per inter-quartile increase of past-3-month-average levels of particulate matter of 2.5µm or less (PM2.5) (16.9µm/m3) were -118 ml on FVC, -100 ml on FEV1, and -127 ml/s on average expiratory flow over the middle half of FVC (FEF25-75%). For ozone, the change was -141 ml/s on FEF25-75% per 19.4 ppb increase in 1st-lag-day level. The pattern of lung function defect associated with PM2.5 was obstructive in children aged 6~10, but restrictive in those aged 11~15. Conclusion: This study suggested that long term exposure to PM2.5 cause adverse effects on FVC, FEV1, and FEF25-75% of schoolchildren. Acute exposure to Ozone cause decrement in FEF25-75%. More studies are needed to clarify the toxicology of PM2.5 on lung function in children with different ages.

Abstract Number	**P-3-05-15**
Presenter	Denis Sarigiannis*, Spyros Karakitsios, Marianthi Kermenidou
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	meta-analysis

Enhancing PM exposure-response functions by incorporating lung deposition and oxidative potential

Background Even though well documented associations have been established between urban air PM and mortality/morbidity, incorporating internal exposure and toxicity metrics would be expected to improve risk assessment. Aims To enhance exposure response functions for mortality and morbidity endpoints using information on human respiratory tract deposition and the oxidative potential of particulate matter. Methods Existing concentration response functions were modified taking into account the fraction of particles deposited across the respiratory tract and relevance to the corresponding health endpoint. The latter also depends on the actual size distribution for a given PM mass concentration, which is better described by the particle number count (PNC). The oxidative potential of particles of different size was also taken into account to derive revised exposure-response functions. Results To investigate the feasibility of using this approach an extensive measurement campaign was carried out in a large Metropolitan area in Greece. PM size and number distributions were recorded in four sites. PM10, PM2.5 and PM1 samples were analyzed for oxidative potential by measuring Reactive Oxygen Species (ROS) using the DTT protocol. Results showed that the fraction of ultra-fine and fine particles is higher in the city center than in the suburbs. The same is true for oxidative potential especially for the smaller particles. Thus, the actual exposure for endpoints related to lower respiratory tract deposition and possibly translocation within the systemic circulation (e.g. cardiovascular disease, adverse pregnancy outcomes) might be up to 4 times higher than the one estimated by the respective differences in mass concentration. Conclusions Our results show that air pollution epidemiology would improve significantly by incorporating evidence based on toxicity metrics, resulting thus in more robust associations between ambient air PM exposure and adverse health outcomes.

Abstract Number	**P-3-05-16**
Presenter	Yueh-Hsiu Mathilda Chiu*, David C. Bellinger, Brent A. Coull, Robert O. Wright, Rosalind Wright
Exposure	ambient air pollution
Health domains	neurodevelopment
Type of research	health impact assessment

Exploring Gender Differences in Relationships of Prenatal Traffic Air Pollution Exposures with Attention and Memory Measures in Early School-aged Urban Children

Background: Prenatal air pollution may impact children’s neurodevelopment albeit research is limited. Studies on gender-specific effects are more sparse. Aims: To examine effects of prenatal exposure to traffic-related black carbon (BC) and fine particulate matter with diameter≤2.5µm (PM2.5) on children's attention and memory measures obtained at age 6.4±0.9 years in a Boston pregnancy cohort (n=150 assessed to date). Methods: BC and PM2.5 estimates were derived using validated spatial-temporal land-use regression models based on mother's residence during pregnancy. Select attention (omission error, commission error, and hit reaction time [HRT] t-scores from the Conners' Continuous Performance Test-II) and memory (general, verbal, and visual memory scores from the Wide Range Assessment of Memory & Learning-2) domains were assessed. Overall associations were examined in multiple linear regression models adjusting for age at assessment, birthweight, child's IQ and gender, maternal race and education, pre- and postnatal maternal stress and maternal smoking. Effect modification by gender was examined in stratified models. Results: Mothers were primarily Hispanic (57%) and African American (30%) with ≤12 years of education (68%); 54% were boys. Median prenatal BC and PM2.5 levels were 0.38 (interquartile range [IQR]=0.30-0.50) µg/m3 and 11.2 (IQR=10.3-11.9) µg/m3, respectively. Overall, an IQR increase in BC was associated with increased omission errors (β=4.3, 95% CI: 0.7-9.2), slower HRT (β=3.5, 95% CI: 0.1-7.0), and decreased general memory (β=-2.6, 95% CI: -6.1 to -0.8). When stratified by gender, we found significant relationships of BC with omission errors and HRT only among boys, and with general and verbal memory only among girls. Patterns for PM2.5 were similar albeit less significant. Conclusions: Prenatal air pollution, especially traffic-related pollutants, may be associated with neurodevelopment in urban children; it may impact specific cognitive domains in boys and girls differently.

Abstract Number	**P-3-05-17**
Presenter	Marisa Estarlich*, Ferran Ballester, Ana Esplugues, Aitana Lertxundi, Inmaculada Aguilera, Mario Murcia, Carmen Iñiguez, Maria-Jose Lopez-Espinosa, Mikel Basterrechea, Jordi Sunyer, Sabrina Llop
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

EXPOSURE TO AIR POLLUTION DURING PREGNANCY AND PLACENTAL WEIGTH IN THREE COHORTS IN SPAIN

Background and Aims: Results from epidemiologic studies suggest an association between air pollution exposure and birth size. The aim is to assess the association between exposure to air pollution during pregnancy and placental weight in the Spanish INMA cohorts in Gipuzkoa, Sabadell, and Valencia. Methods: Exposure to traffic air pollution to nitrogen dioxide (NO2) during pregnancy was estimated combining spatial modeling (land use regression) and temporal correction for residence for each trimester and the whole pregnancy for women participating in the INMA cohorts. Study population was 1947 pairs of mothers and their offspring with complete data. Outcomes included were placental weight and placental to fetal weights ratio (PFR). The association between air pollution exposure and birth outcomes was assessed by cohort with linear regression models adjusted for potential confounders. We performed a combined analysis with meta-analysis techniques. Also, we performed sensitivity analysis for the subset of women who spent ≥15 hr/day at home during pregnancy. Results: NO2 mean level correspondent to the pregnancy period was 20.1 (sd: 6.4), 31.9 (8.6) and 36.9 (11.1) µg/m3 to Gipuzkoa, Sabadell and Valencia, respectively. All results by cohort showed no heterogeneity (I2<50%). In the combined analysis, we did not find a significant association between NO2 exposure during pregnancy and either placental weight (β=0.9; 95% CI= -5.8, 7.7) or PFR (% change=0.4; 95% CI= -0.5, 1.13). When the sample was restricted to women who spent ≥15 hr/day at home, the results did not change substantially (-1.4; 95% CI= -10.4, 7.6). By trimesters, the results were neither significant. Conclusions: We did not found association between residential NO2 exposure during pregnancy and placental weight. Funded by: Ministry of Science, Spain: ISCIII (G03/176), FIS-FEDER 03/1615, 04/1509, 04/1112, 06/1213, 09/02647 and Fundació Roger Torné

Abstract Number	**P-3-05-18**
Presenter	Sanghyuk Bae*, Young Ah Lee, Jin Hee Kim, Seung Joon Chung, Choong Ho Shin, Yun Chul Hong
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Exposures to air pollutants during pregnancy and weight of the children

Background: Exposure to air pollution during the pregnancy has been associated with adverse birth outcome. Air pollution is also suspected to affect growth of children, however, little is known about the adverse effect of exposure to air pollution during the pregnancy on growth after birth. Aim: The aim of the present study was to examine the association between exposure to air pollution during pregnancy and weight of the children at age 2. Methods: Environmental Health Center at College of Medicine, Seoul National University had constructed a cohort of 13,278 pregnant women and followed-up until the birth of the child from Aug. 2008 to Jul. 2011. The addresses of mothers were matched to the ambient concentrations of air pollutants (PM10, SO2, NO2, CO and O3) measured at the nearest monitoring station. We randomly selected and measured the weight of 205 children at the age of 2. We analyzed the associations of the ambient concentration of pollutants during the pregnancy with birth weight and weight of the children measured at age 2 using linear regression models. All analyses were adjusted for sex of baby; month of birth; mother's weight, age, parity, smoking, drinking and duration of the pregnancy. We further adjusted the birth weight for the analysis at age 2. Results: Exposures to CO and O3 during the entire pregnancy significantly and negatively associated with birth weight. The regression coefficients of CO and O3 for 10 ppb increase were -6.53 (SE=2.56, P=0.0116) and -447.20 (SE=130.21, P=0.007), respectively. However, the associations were not significant at the age of 2. Conclusion: We observed negative association of air pollution exposure during the pregnancy with birth weight, but not with children's weight at the age 2.

Abstract Number	**P-3-05-19**
Presenter	Evi Dons*, Martine Van Poppel, Sofie De Prins, Tim S. Nawrot, Luc Int Panis, Gudrun Koppen
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

HEAPS Study Design: Health Effects of Air Pollution in Antwerp Schools

The HEAPS study (Health Effects of Air Pollution in Antwerp Schools) was set up to evaluate the health impact of traffic related air pollution on school children in Flanders, Belgium. The study comprises the biomonitoring of 130 children (aged 6-12) from 2 schools and simultaneous air quality monitoring. All air quality and health measurements were performed in both spring and autumn 2011. One of the schools was located next to a busy road of 20,000 vehicles/day, the other school was located at an urban background location. Air quality measurements were performed at the schools (UFP, PM, BC, NOx, and O3), at a selection of 40-50 home locations (BC, NO2) and while in transport (UFP, BC). The measurements were translated into exposure estimates in different time frames: respectively evaluating acute health effects, subacute effects (1 to 10 days before sampling), and long term health effects. The land use regression technique was applied to estimate BC and NO2 concentrations at unmeasured locations. In the exposure assessment, the time-activity pattern of the children and concentrations in different micro-environments were taken into account. Next to this, personal NO2 samplers were carried by the children during one week. Health assessment consisted of measurements of fractional exhaled nitric oxide (FeNO), exhaled breath condensate (EBC) markers (pH, 8-isoprostane, cytokines), and urinary 8-oxo-2'-deoxyguanosine (8-oxodG). Additionally, allergic inflammation in the nose was assessed in spring with a Rhinostick, while in autumn the Rhinostick was used to analyze nasal concentrations of IL-8, eosinophilic cation protein (ECP), and tryptase. ISAAC-type questionnaires on asthma, rhinitis and eczema symptoms were distributed amongst all children attending one of the schools. Acknowledgement: the study was financed by the Flemish Environment Agency (VMM), the Flemish Administration of Environment, Nature and Energy (LNE), and the Flemish Agency for Care and Health (VAZG).

Abstract Number	**P-3-05-20**
Presenter	Tamara Schikowski, Andrea Vierkötter*, Dorothea Sugiri, Nicole Probst-Hensch, Nino Kuenzli, Ursula Krämer
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Long term air pollution exposure and COPD in SALIA: Discrepancies between ESCAPE results and published evidence in SALIA

Background: In a cross-sectional investigation in 1985 and 1994, women from the SALIA study showed a strong association between air pollution with lung function and COPD. In the frame of the ESCAPE project, from 2008 and 2012, where data of lung function and exposure were used from a follow-up investigation in 2008, the previous association could not be replicated. Aim: To explore the differences between the two analyses and to identify the responsible changes, which explain the discrepancies between ESCAPE results and published evidence. Method: Multiple regression analyses were used to estimate the effect of air pollution on lung function and COPD. We changed factors that differ between the two analyses step by step to identify factors that are responsible for the discrepancies in the results. Results: Thebaseline analysis showed a significant positive association between COPD and PM10 with an OR of 1.68 (95%CI: 1.01-2.78) per 10 µg/m3. The analysis in the frame of the ESCAPE project showed a non-significant OR of 0.93 (95% CI: 0.72-1.21) for the outcomes. Differences in the ESCAPE analysis compared to the baseline analysis were the following: inclusion of a subgroup of surviving women (N=541 vs. N=2095), use of lung function data of 2008 with different spirometer, use of a more detailed exposure assessment in 2008 and use of a different set of covariates. The differences in result were due to the inclusion of surviving women as the prevalence of COPD at baseline was already lower in this subgroup in comparison to the whole group (2.1% compared to 3.5%) and the use of the lung function from 2008 as lung function deteriorates between baseline and 2008. Conclusion: The association of air pollution on COPD was less pronounced in the surviving women at follow-up than in all women from baseline and an effect of air pollution on lung function could not be detected in 2008. This might be due to the strong decline in PM10 pollution between 1984 and 2008.

Abstract Number	**P-3-05-21**
Presenter	Pouria Heydarpour, Hassan Amini*, Shayan Khoshkish, Mohammad Ali Sahraian, Masud Yunesian
Exposure	ambient air pollution
Health domains	autoimmune disease
Type of research	cross-sectional study

Long-term air pollution exposure and multiple sclerosis

Background: Multiple sclerosis (MS) is an inflammatory demyelinating and neurodegenerative disease leading to disability in young adults. The MS incidence has dramatically increased in last two decades in the Middle Eastern City of Tehran, Iran. The role of environmental factors is well established in MS natural history; however there are few studies considering the potential role of air pollutants in MS pathogenesis. Aims: The aim of this study was to compare the mean exposure to different air pollutants in incident of MS cases in Tehran, Iran with the exposure of the general population. Methods: Records of 1808 patients meeting McDonald's criteria for definite MS diagnosis were obtained from Iranian Multiple Sclerosis Society (with disease onset during 2003-13). Thereafter, they were successfully geo-coded within Tehran metropolis by Geographic Information System (GIS) Bureau of Iran's Post Office based on their postal code. On the other hand, 8752 random cases were created within the city by a GIS. The long-term exposure of all MS cases and random cases to sulfur dioxide (SO2), nitrogen oxide (NO), nitrogen dioxide (NO2), nitrogen oxides (NOx) and particulate matter ≤ 10 µm (PM10) air pollutants were estimated using land use regression models. Finally, independent-samples t-test was used to compare mean exposure of the mentioned groups. Results: Our analysis demonstrated that the annual mean exposure for SO2, NO, NO2, NOx and PM10 air pollutants in MS cases were 58 parts per billion (ppb), 125.2 ppb, 48.1 ppb, 113 ppb, and 99.1 µg/m3, respectively. While in our random points the mean exposures for mentioned pollutants were 52.5 ppb, 108.9 ppb, 41.1 ppb, 102 ppb, and 93 µg/m3, respectively. The independent samples t-test revealed a significant difference ($P<0.001$) in exposure to SO2, NO2, NOx and PM10 but not for NO in incident MS cases compared with our random points. Conclusions: This study revealed the potential role of long term exposure to air pollutants as an overlooked environmental factor in the MS pathogenesis.

Abstract Number	**P-3-05-22**
Presenter	Hak Kan Lai*, Anthony J Hedley, Hilda Tsang, Thuan Quoc Thach, Ruby SY Lee, Tai Hing Lam, Chit Ming Wong
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Long-term health effects of air pollution incorporating horizontal and vertical spatial variations of PM2.5 concentrations

Background Previous long-term studies have estimated the horizontal spatial variation of particulate matter (PM) based on geospatial dispersion model and satellite information. None has incorporated vertical spatial variation in estimations of exposures and health effects for people living in high rising buildings. Aim To assess the effects on mortality attributable to long-term exposure to PM2.5, incorporating heights of residential addresses for a cohort of older people in Hong Kong enrolled in Elderly Health Centres (EHC). Methods The height above mean sea level and coordinates of 66,820 residents (aged 65+) enrolled between 1998-2001 in 18 EHC in Hong Kong were derived from address data. Individual's annual mean exposures to PM2.5 were modelled (R2=0.94) using NASA's satellite surface extinction coefficients (SEC) linked with the coordinates, inverse heights of residents, and ambient temperatures. Cox regression using subject's age as time-scale was used to assess the hazard ratios (HR) associated with annual mean exposures to PM2.5 on mortality after adjustment for gender, smoking, alcohol, exercise, regular medications, social welfare assistance and education. Results Mean annual exposures to PM2.5 among all subjects were 31-40 µg/m3 in 1998-2011. The excess risk (%; 95% CI) of mortality (HR-1) per 10 µg/m3 increase of PM2.5 was 9.2 (6.3, 12.1) for all-natural causes [ICD10:A00-R99]; 12.5 (7.1, 17.9) for cardiovascular diseases [I00-I99] and 21.7 (13.4, 30.1) for ischemic heart diseases [I20-I25]; 8.2 (1.4, 15.1) for respiratory diseases [J00-J47] and 10.8 (2.7, 19.0) for influenza and pneumonia [J9-J18]. Conclusions Long-term exposures to PM2.5, taking into account the three-dimensional scale, are strongly associated with mortality for all-natural causes and cardio-respiratory diseases among the older Chinese population in Hong Kong. Acknowledgement We thank Wellcome Trust for fnding of this study.

Abstract Number	**P-3-05-23**
Presenter	Hsiao-Ching Lin*, Szu-Ying Chen, Chang-Fu Wu, Jui-Huan Lee, Barbara Hoffmann, Annette Peters, Bert Brunekreef, Chang-Chung Chan
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term particulate matter exposures lowers blood pressures of elderly population aged above 65

BackgroundFindings are inclusive in previous studies on blood pressure (BP) changes by long-term PM exposures. Aims This study tries to investigate whether BP of aged population will be lowered by one-year exposures to PM2.5, PM2.5 absorbance, PM2.5-10, and PM10-. MethodsOur study population included a cohort of 30,439 elderly people aged above 65 in Taipei City in 2009. We applied the exposure assessment approach of European Study of Cohorts for Air Pollution Effects (ESCAPE) to develop land-use regression models for estimating one-year averaged concentrations of PM2.5, PM2.5 absorbance, PM2.5-10, and PM10 for our epidemiological cohort in Taipei. Both censored and non-censored multiple linear regression analyses were performed to examine associations between blood pressure changes and PM exposures as well as the distance to the nearby elevated highways (km) and adjusting for individual's BMI, smoking, alcohol consumption, physical activity, education, and anti-hypertensive medication. ResultsOne-year averaged exposures were 28.22±3.92μg/m3 for PM2.5, 53.68±6.03μg/m3 for PM10 , 23.13±2.25μg/m3 for PM2.5-10, and 2.07±0.38)× 10-5 m-1 for PM2.5 absorbance for 30439 subjects aged 74.96±6.43.Non-censored regressions show that systolic BP (SBP) was marginally decreased by 0.76 (-1.52 to 0.09) mmHg per 10-5 PM2.5ABS and pulse pressure (PP) was decreased by 0.57 (-1.16 to 0.02) mmHg per 10-5 PM2.5ABS. In contrast, the reduction in 0.72 (-1.58 to 0.14) mmHg of SBP and 0.84 (-1.53 to -0.15) mmHg of PP for subjects with anti-hypertensive medication was greater than those without medication. Censored regressions show that SBP was significantly decreased by 0.91 (-1.73 to -0.09) mmHg per 10-5 PM2.5ABS and PP was decreased by 1.25 (-1.88 to 0.62) mmHg per 10-5 PM2.5ABS.. The distance to nearby elevated highways accounted for another reduction in SBP among medicated subjects. Conclusions One-year exposures to PM2.5 absorbance can lower blood pressures among population aged 65.

Abstract Number	**P-3-05-24**
Presenter	Olivier Laurent*, Jun Wu, Lianfa Li, Jianlin Hu, Myles Cockburn, Mike Kleeman
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Low birth weight and exposure to particles and ozone in Los Angeles County, California

Background Low birth weight (LBW, <2,500 g) is often associated with exposure to particles of coarse (PM10) and fine (PM2.5) size fractions, but their association with ultrafine particles (PM0.1) has seldom been studied. Beside, It is unclear which sources of particles increase the risk of LBW. Studies of ozone (O3) and LBW have reported mixed results. Aims To study the relationships between LBW in term born infants (>37 weeks gestation) and exposure to particles and ozone in Los Angeles County (California, USA) over period 2001-2006. Methods Primary particulate matter concentrations were modeled at a 4 km*4 km grid resolution, by emission source (high sulfur fuel, diesel, gasoline, wood, cooking, shipping and others), for PM10, PM2.5 and PM0.1. Ambient total PM2.5 and O3 concentrations measured by monitoring stations were interpolated using empirical Bayesian kriging. Birth certificates (n= 726,871) with maternal addresses at delivery were geocoded to parcel level whenever feasible. The associations between LBW and air pollutants concentrations averaged over the whole pregnancy were examined using generalized additive models, adjusting for maternal age, parity, race/ethnicity, education, neighborhood income, gestational age and infant sex. Results In preliminary analyses, LBW (n=17,169) is positively associated with exposure to PM10, PM2.5 and PM0.1 emitted by food cooking and gasoline sources. Marginally significant associations are also observed for total primary PM2.5 (p=0.06) and PM0.1 (p=0.05). No significant association is observed with interpolated total PM2.5 or O3. Conclusions These preliminary results suggest that the risk of LBW is positively associated with exposure to total primary PM2.5 and PM0.1,and with primary PM10, PM2.5 and PM0.1 emitted by food cooking and gasoline. Further analyses are underway to assess the robustness of these findings.

Abstract Number	**P-3-05-25**
Presenter	Richard Atkinson*, Iain Carey, H. Ross Anderson, Derek Cook, Andrew Kent, Tjeerd Van Staa
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Mortality associations with long-term exposure to outdoor air pollution in a national English cohort

Background: Long-term exposure to ambient levels of fine particulate matter has been associated with increased mortality, particularly from cardiovascular disease. Relatively few studies have investigated these relationships in nationally representative population samples, in European populations or included gaseous pollutants. Aim: To investigate the relationship between long-term exposure to a range of pollutants and mortality in a national English cohort. Methods: 835,607 patients aged 40-89 years, registered with 205 general practices were followed from 2003-7. Annual average concentrations in 2002 for particulate matter with a median aerodynamic diameter <10 and <2.5 (PM2.5) microns, nitrogen dioxide (NO2), ozone and sulphur dioxide (SO2) at 1km2 resolution, estimated from emission based dispersion models, were linked to patient residential postcode. Deaths were ascertained from linkage to death certificates, and hazards ratios (HR) for all- and cause-specific mortality for pollutants were estimated from Cox models adjusting for age, sex, smoking, body mass index and area-level socioeconomic status (SES). Results: All pollutants (except ozone) were positively associated with all-cause mortality (83,103 deaths), between 2% and 6% increase in risk per inter quartile range increase in pollutant concentrations. Associations with PM and NO2 were larger for respiratory deaths (e.g. HR, 1.09; 95% confidence interval, 1.05-1.13, per 1.9 µg/m3 of PM2.5) but nearer to unity for cardiovascular deaths (for PM2.5 HR=1.00; 0.97-1.03). SO2 was positively associated with all causes of mortality. Conclusions: These results strengthen the evidence linking long-term ambient air pollution exposure to increased all-cause mortality. However, the stronger associations with respiratory mortality are not consistent with the majority of US studies in which associations with cardiovascular causes of death tend to predominate.

Abstract Number	**P-3-05-26**
Presenter	Maria Angela Vigotti*, Maria Rosa Montinari, Emilio Antonio Luca Gianicolo
Exposure	ambient air pollution
Health domains	other
Type of research	others

MORTALITY TREND IN APULIA PROVINCES, ITALY, 1949-2008

Background Since the late 60s, in Apulia, in South-East of Italy, huge (in size and harmfulness) industrial sites have settled in close proximity to some cities. InLecce province, less heavily industrialized, male lung cancer mortality is a serious problem Aims To estimate mortality trends by total and specific causes covering the time frame 1949-2008, to evaluate the possible loss in health advantage of Southern Italy residents . Methods. Data come from historical publications of National Institute of Statistics: total number of deaths, by province, by specific causes but not by sex; national data instead disaggregated by sex, age and cause since 1927. Causes chosen after a careful evaluation of theICD codes ranging from ICD-5 up to ICD-10. SMR% (Standardized Mortality Ratio) have been computed. At the moment only mortality by all causes, respiratory cancers and pneumonia have been investigated since 1949. Results General mortality is on average lower than national levels, except in Taranto. In Lecce respiratory cancer mortalityshows higher values (+ 3 up to +6%) since early seventies and Relative- SMR% (ratio to SMR by all causes) is growing with time (from +5% up to +10%) , while in Taranto it declines rapidly. Pneumonia mortality is clearly declining with time. The ratio with Apulia SMR% shows in Taranto high mortality (since 1981 for total and pneumonia mortality, since 1961 for respiratory cancer), in Lecce higher respiratory cancer mortality since 1971, while Bari shows higher mortality by pneumonia in all period. Conclusions As already known mortality in Apulia province is still lower than the national levels, but inside the region Taranto province shows higher mortality for the causes investigated. Bari emerges for high values of pneumonia deaths, while high respiratory cancers mortality is confirmed in Lecce since 40 years, and this corroborate the hypothesis of a local risk factor, as e.g. tobacco cultivation and manufactures.

Abstract Number	**P-3-05-27**
Presenter	Nitaya Vajanapoom*, Nuntavarn Vichit-Vadakan, Thach Thuan-Quoc
Exposure	ambient air pollution
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Neurobehavioral impairments of residents residing near petrochemical plants: a cross-sectional study

Background: A growing body of literature shows that residents residing near petrochemical plants (PP) are associated with adverse health outcomes. However, studies on possible effects on neurobehavioral functions are limited. Objectives: To assess the effects of residing near (PP) on neurobehavioral performances of population in an industrial area. Methods: We conducted a cross-sectional study in June 2010 in four sub-districts, with a population of about 60,000 people, in Rayong Province the largest industrial area in Thailand. Residents (n=5,134) aged 6 to 50 years residing in the area were included in the study. We used Digit Symbol-Coding to assess the relationship between hand and eye of all subjects; and Digit span to test short-term memory. The mean distance from residences to the centroid of clusters of the PP was measured using GIS and categorized into four levels by quartile: residing extremely near, residing very near, residing near and residing far from the PP. Multiple linear regressions were used to assess the association between neurobehavioral performances and distances. Results: After adjustment for age, sex, education level, smoking, environmental tobacco smoke, indoor and outdoor (VOC) and traffic related VOC, a score in coding was inversely associated with residing extremely near PP (−0.76 points; 95% CI: −0.99, −0.53), residing very near (−0.47; −0.70, −0.23) and residing near (−0.20; −0.44, 0.04) relative to residing far from PP. A score in digit was inversely associated with residing extremely near PP (−0.40;−0.60, −0.19), residing very near (−0.29; −0.49, −0.08) and residing near (−0.20; −0.41, 0.02) relative to residing far from PP. Conclusions: Residents residing near petrochemical plants were associated with impaired performances on neuropsychological tests when compared with those residing other areas. There is an urgent need to call for enforcement of regulatory standards to protect the population residing near industrial areas.

Abstract Number	**P-3-05-28**
Presenter	Jonathan Thornburg*, William Barrett, Jed Januch, David Berry, John Kominsky, James Konz
Exposure	others
Health domains	cancer
Type of research	exposure measurement

New Methods for Assessing Exposure to Asbestos and Other Fibrous Minerals to Inform Risk Assessment

Exposure to asbestos and related mineral fibers released from soil is a growing public health hazard. Known public health risks exist in Turkey, Korea, Israel, Italy, and the United States. Soil contamination may be naturally occurring, asbestos containing material production, or demolition of buildings containing asbestos. This presentation compares three new methods to evaluate human health risks due to exposure to asbestos-contaminated soil: activity-based sampling (ABS), the Releasable Asbestos Field Sampler (RAFS), and Fluidized Bed Asbestos Segregator (FBAS). ABS measures exposure to asbestos in the breathing zone of a person performing a specified task, while the RAFS measures the release of asbestos from soil and is coupled with a breathing zone model to predict exposure. The FBAS measures the presence or absence of asbestos in soils by separating asbestos structures and other small particles from other soil. Collocated comparison of the three methods was conducted at 15 asbestos-contaminated sites across the U.S. to determine the representativeness, sensitivity, and precision of the methods. Asbestos levels measured by all three methods are highly correlated. Air concentrations generated by the RAFS over-predict exposure compared to ABS (slope = 12.5, R2 = 0.68) because the RAFS measures asbestos emissions at the soil surface and is not affected by factors that disperse fibers during transport to the breathing zone. RAFS measured emissions are correlated with the FBAS determined soil loading (slope = 1.48, R2 = 0.75). All three methods detect asbestos at soil loadings less than 0.1%, the limit for the standard polarized light microscopy method. The precision of the methods ranges from < 5% to more than 80% because of the asbestos heterogeneity in the soil. These new methods are useful for assessing asbestos exposure. Each is complimentary to the other. Therefore, a new paradigm for evaluating exposure concentrations to inform cancer risk assessment is being developed.

Abstract Number	**P-3-05-29**
Presenter	Linda Kachuri*, Shelley A Harris, Marie-Élise Parent, Kenneth C Johnson, Paul J Villeneuve
Exposure	others
Health domains	cancer
Type of research	case-control study

Occupational exposure to crystalline silica and the risk of lung cancer in Canadian men

Background: Crystalline silica is a highly prevalent occupational exposure and recognized human carcinogen, however its association with lung cancer remains contentious. Aims: We investigated the relationship between occupational silica exposure and lung cancer, and the combined effects of cigarette smoking and silica exposure on lung cancer risk. Methods: This was a population-based case-control study with 1681 incident lung cancer cases and 2053 controls from 8 Canadian provinces between 1994 and 1997. Self-reported questionnaires were used to obtain lifetime occupational history and information on other risk factors. Occupational hygienists, blinded to case-control status, assigned silica exposures to each job on based on concentration (low, medium, high); frequency (<5%, 6-30%, >30% of time in a typical week); and reliability (possible, probable, definite). Logistic regression was used to estimate odds ratios (OR) and their 95% confidence intervals. Four exposure metrics were modeled: ever exposure, concentration, duration, and cumulative exposure. Models were adjusted for cigarette smoking, exposure to second-hand smoke, and occupational exposure to diesel and gasoline. Results: A statistically significant trend in lung cancer risk was observed with increasing duration of exposure to silica at any concentration (OR for ≥20 years=1.57, 1.22-2.03; ptrend=0.002), and persisted when exposures were restricted to low concentrations (OR for ≥30 years=1.58, 1.15-2.16; ptrend=0.02). The highest tertile of cumulative silica exposure was associated with lung cancer (OR=1.41, 1.10-1.81; ptrend=0.04) relative to the lowest tertile. Men exposed to silica at low concentrations with ≥40 cigarette pack-years had the highest risk relative to those unexposed with <10 pack-years (OR=25.40, 17.21-37.50). The joint relationship with smoking was consistent with an additive model. Conclusions: Our findings suggest that occupational exposure to silica is an independent lung cancer risk factor.

Abstract Number	**P-3-05-30**
Presenter	Jung Ah Kim*, Su Ryeon Noh, Yong Jin Jeon, Hyun Sook Bae, Gwi Heum Eom, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Persistent Respiratory Health in Children 3 Years After the Hebei Spirit Oil Spill

Background: It was shown that there is a respiratory health risk for children from oil spill exposure when we performed the baseline survey 1.5 years after the accident. Aims: The purpose was to check whether or not the respiratory health of the children still related to oil spill exposure. This was conducted as a follow-up survey 3 years after the Hebei Spirit oil spill accident. Methods: Re-participated 517 elementary and 243 middle school students were followed by the same questions and health check-up included skin prick test and pulmonary function test as in the initial survey. We carried out the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire to analyze respiratory symptoms in our subjects. Results: Respiratory symptoms in the participants decreased by an increase of the distance from oil spill site to residence or schools. Especially, the results were more significantly prevalent in children than adolescent. The prevalence of asthma in children was twice higher than the nationwide asthma prevalence of Korea (11.3% vs. 4.7%). The percentage of predicted FVC and predicted FEV1 were significantly lower in high exposed school group than less exposed school group in children. There were no significant differences in the prevalence of respiratory symptoms between the baseline and the follow-up survey. A positive response to the skin-prick test increased about twofold more in follow-up than baseline measured 1.5 years earlier. Conclusions: The oil spill might cause a significant impact on the sensitive population group—especially in children's persistent respiratory health for a long time. Further study should be conducted to determine the influence oil spill on respiratory health at a longer term.

Abstract Number	**P-3-05-31**
Presenter	Francesco Forastiere*, Carla Ancona, Giulia Cesaroni, Claudio Gariazzo, Alessandro Marinaccio, Stefania Massari, Francesca Mataloni, Roberto Sozzi, Massimo Stafoggia
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Population-based cohort studies to assess long-term health effects of environmental and occupational exposures close to industrial and contaminated sites in Ita

< Background. Health effects of airborne pollutants in urban areas are well studied but scanty data are available from industrial sites where multiple production activities are close to population communities. The interpretation of ecological studies is hampered by the fact that concurrent occupational exposures to toxic substances may entail health risk. Aims. To develop an integrated approach based on population cohort studies, individual exposure assessment based on dispersion modeling, and survival analyses.. Methods. The residential cohorts are defined from Municipal Registers. Cohort members are linked with the National Pension Fund, which include employing company, industrial sector, and duration of employment. Data from the 2001 Census are used to assess area-level deprivation indices. Residential addresses are geocoded and used to estimate individual environmental exposures (Lagrangian dispersion models), distance from other industrial sites, major roads, and traffic-related air pollution indices. Cause specific mortality and hospital admissions are available to provide the mortality/morbidity follow-up of the subjects. Results. Some results have been published, such as the Rome Longitudinal Study (Cesaroni et al, EHP 2013), and additional studies are on going. Astudy has been conducted in the area of Taranto, Southern Italy, including 321,356 subjects followed from 1998 to 2010 (Mataloni et al, E&P 2012). Health effects related to the large steel industry have been found, especially for cardiac and respiratory disorders. In addition, increased mortality from cancers, neurological, heart disease among workers at the plant has been detected. Conclusions. We have developed an innovative approach integrating modeling development, full use of registry data, and epidemiology data analysis techniques to provide science-based information on health risks attributable to environmental and occupational exposures around industrial sites in Italy.

Abstract Number	**P-3-05-32**
Presenter	Pallavi Balte*, Kathleen Clark, Lawrence Mohr, Wilfried Karmaus, Dennis Ownby, Daniel Salerno, Bo Cai, John Vena, Erik Svendsen
Exposure	others
Health domains	respiratory disease
Type of research	cross-sectional study

Potential Airway Obstruction 7 years Following Exposure to Chlorine

Background: On January 6, 2005 there was a train derailment which released~54,430 kg of chlorine into the town of Graniteville, SC, USA, population~7,000. Aim: To assess long-term pulmonary health effects of a single high-concentration exposure to chlorine gas. Methods: Since summer 2012 diagnostic pulmonary function tests with single breath carbon monoxide diffusing capacity(DLCO) are being provided to 600 former Graniteville cotton mill workers to assess long-term health consequences of chlorine exposure(N to-date= 83). Demographic information, respiratory symptoms, exposure and smoking history abstracted from occupational records before the chlorine release are being linked to prospective health assessments. Preliminary data for participants whose lung volumes and DLCOs met ATS criteria were included (lung volumes: n=65, 19/46 exposed/unexposed, DLCO: n=72, 20/52 exposed/ unexposed). Mean percent predicted measures for pulmonary function parameters and DLCO adjusted for hemoglobin were compared between exposed and unexposed millworkers using Fisher exact and T-test. Results: We found a significant increase in percent predicted residual volume (RV) and total lung capacity (TLC) in exposed millworkers (p=0.02). The proportion of millworkers with lower predicted FEV1/FVC ratio was significantly higher in exposed than in unexposed (p<.0001). There were 7/19(37%) exposed who have FEV1/FVC ratio less than 70% of predicted as compared to 3/46(6.5%) unexposed and 10/19(53%) exposed who had FEV1/FVC ratio less than 75% of predicted as compared to 9/46(20%) unexposed. Four of 20 exposed (20%) showed a moderate decrease in DLCO as compared to 6 of 52 unexposed (11%). Conclusion: Our preliminary findings suggested that inhalation of high concentration chlorine increased RV and TLC and decreased FEV1/FVC ratio 7 years after exposure, indicators of airway obstruction or destroyed alveolar septa leading to emphysema like changes. Further research is needed to discern the mechanism behind these changes.

Abstract Number	**P-3-05-34**
Presenter	Auriba Raza*, Tom Bellander, Getahun Bero Bedada, Marcus Dahlquist, Jacob Hollenberg, Martin Jonsson, Tomas Lind, Mårten Rosenqvist, Leif Svensson, Petter L. Ljungman
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	case-crossover study

Short-term Effects of Air Pollution on Out-of-Hospital Cardiac Arrest

Background: Although ozone has been associated with cardiovascular morbidity and mortality, the effects of ozone on out-of-hospital cardiac arrest (OHCA) has rarely been addressed and studies investigating the link between OCHA and air pollution have presented inconsistent findings. Aim: The objective of this study is to investigate the effects of short-term exposure to air pollution, including ozone on OHCA and effect modification by season, age, and gender. Methods: A total of 5973 OHCA Emergency Medical Service-assessed cases in Stockholm County 2000-2010 were obtained from the Swedish cardiac arrest register. The urban background O3 level was on average 51.2µg/m³ during the study period. A time-stratified case-crossover design was used to analyze exposure to air pollution and the risk of OHCA. Moving 2-h, 24-h and 3-day averages for urban background O3, PM2.5, NO2, and NOx were constructed from hourly means preceding the event and control time points. We adjusted for temperature and relative humidity. Results: Ozone levels were associated with increased risk of OHCA, for 2-h, 24-h and 3-d exposure windows. The respective odds ratio (OR; confidence interval) for a 10 µg/m3 increase were 1.02 (1.00-1.05), 1.04 (1.01-1.08) and 1.05 (1.01-1.09). The association with 2-h ozone was stronger for events that occurred outdoors compared to indoor events: 1.13 (1.06-1.21) vs 1.02 (0.99-1.04; p value for interaction = 0.05). We saw no effects for other pollutants and no effect modification by age, gender or season. Conclusion: Elevated levels of ozone are associated with risk of OHCA.

Abstract Number	**P-3-05-35**
Presenter	Melissa Smarr*, Luis O. Rivera-González, Felipe Vadillo-Ortega, Marie S. O'Neill
Exposure	ambient air pollution
Health domains	reproductive outcomes
Type of research	cohort study

The Association between First Trimester Maternal Exposure to Air Pollutants and Indicators of Fetal Growth in Mexico City

Background: Maternal exposures to air pollution in early pregnancy may affect subsequent fetal growth. Aims: We examined the association between first trimester maternal exposure to air pollution and ultrasound-assessed indicators of fetal growth during pregnancy. Methods: Data were collected during multiple prenatal visits of 274 mother-fetal pairs recruited in Mexico City, Mexico between 2009-2012. Individual-specific first trimester exposures to PM2.5 and O3 were estimated using citywide average concentrations reported from ambient air monitors. Random slope and intercept mixed effect models were fit to assess pollution associations with two ratio measures from repeated fetal ultrasounds: femur length (FL) to abdominal circumference (AC) (FL/AC); and head circumference (HC) to AC (HC/AC). Clinical indicators of normal (proportional) growth for HC/AC and FL/AC ratios are 1.1 and 0.20-0.22, respectively. Ratios above the 95th percentile may represent fetal growth restriction. Models were adjusted for maternal age, pre-pregnancy BMI, vitamin intake and stratified by fetal sex, as in utero growth differs by sex. Results: On average, the FL/AC ratio was 0.22 (±0.02) and the HC/AC ratio was 1.09 (±0.10). Women exposed to O3 levels higher than 16.05 ppb during the first trimester showed a decrease of 0.007(p=0.01) in FL/AC ratio during gestation; associations did not differ by fetal sex. However, change in FL/AC ratios per 10 µg/m3 (IQR) increments of PM2.5 were -0.0005 (p= 0.90) for males and 0.0050 (p=0.23) for females. HC/AC ratios increased with higher exposure to PM2.5 (0.0100, p=0.28) and O3 (0.0005,p=0.97); point estimates did not differ by fetal sex. Conclusions: First trimester exposures to air pollutants may affect indicators of in utero fetal growth uniquely; with responses differing by fetal sex. Further analyses will use participant's geo-referenced location for air pollution exposure analyses and evaluate effect modification by nutritional factors.

Abstract Number	**P-3-05-36**
Presenter	Teresa Moreno*, A. Wlodarczyk, K Berube, T Jones, Cristina Reche, Aurelio Tobias, BREATHE Participants
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Toxicological effects of indoor PM10 in urban primary schools in Barcelona, Spain

Background. The BREATHE project, funded by the EU and led by CREAL in Spain, has conducted a campaign measuring aerosols in primary schools in Barcelona. Monitoring sites were separated into high and low-pollution areas with the primary aim of recognizing if differences in air pollutants affect the neurological system of children and their behaviour at school. Aims. Within BREATHE the CECAT sub-project is considering the toxicological aspect of the problem by investigating the toxicity of PM looking at its ability to induce a systemic oxidative stress which damages cells and DNA molecules. Methods. A total of 20 schools were sampled (10 with high traffic density and 10 with low). The sampling took place inside the classrooms for 4 consecutive days at 2 different times a year (winter/summer 2012) to take into account the changes of air pollutants in different climatic conditions. To determine particle oxidative capacity, PM10 in the classrooms was collected using an Airborne Sample Analysis Platform system (ASAP; Model 2800 Thermo) on PUF substrates (sample flow-rate 200 l/min). The genotoxicity, inflammatory potential and cytotoxicity of the PM10 samples are being elucidated using 3 complementary biological assays: Plasmid Scission Assay (PSA) – genotoxicity; DCFH ROS Assay - potential pro-inflammatory; F-actin polymerisation Assay – cytotoxicity. Results. PSA results show the PM dose able to damage 50% of a plasmid DNA molecule (TD50 values), an indication of the ability of the PM sample to exert potential oxidative stress. The TD50 values obtained so far reveal wide variations, although most values are higher than those for outdoor air, implying that PM in indoor air is causing less damage. There does not appear to be an obvious link between TD50 values and concentrations of NO2 and Black Carbon. The full toxicological dataset, including DCFH and ROS F-actin polymerisation assays will be presented at the conference.

Abstract Number	**P-3-05-37**
Presenter	Jia Liu*, Sarah Uhl, Gavin F. Pereira, Michelle L. Bell
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	review

Wildfire Smoke and Community Health: A Literature Review

Background: Climate change may increase the frequency and severity of forest and wild fires in many parts of the world. Better understanding of the human health impacts of the resulting air pollution has important public health implications for the future and the present day. Aims: We reviewed and summarized the published literature concerning the human health impacts from wildfires. Method: We performed a systematic search on Pubmed and Scopus to identify peer-reviewed scientific studies in English regarding health impacts of wildfire smoke in exposed communities. Results: We identified 54 epidemiological studies in affected communities. The most commonly used methods for assessing exposure is obtaining air pollutant data from air monitors (59.3% of the studies). The most commonly used methods to assess health outcomes is using data from governmental agencies or statistical bureaus (48.1% of the papers). Thirty-eight studies investigated respiratory health, and 86.84% of them found that wildfire events can significantly increase the risk of respiratory disease. Twelve examined wildfire impact on mortality, among which 75% found a significant increase in mortality after wildfire events. Relatively few studies attempted to connect cardiovascular disease and wildfires. Children, the elderly and those with underlying chronic diseases appear most susceptible and should be the priority of public health programs. Conclusions:Air pollution from wildfires under changing climate can increase the risk of respiratory disease, mortality, and possibly cardiovascular disease among people from affected communities. Current literature on fire and health is limited and suffers from limitations. Future work with large-scale research, employment of satellite images and simulation models, vulnerability assessment, and long-term projections could help evaluate the public health impacts of climate change and guide mitigation policies.

Abstract Number	**P-3-07-01**
Presenter	John Gulliver*, Danielle Vienneau, Daniela Fecht
Exposure	noise
Health domains	no health domain
Type of research	exposure modeling

A new GIS-based traffic noise model for London (UK)

Background There is evidence for adverse health effects of noise exposure especially in relation to increased risk for cardiovascular conditions and risk factorsincluding hypertension. Within the London 'TRAFFIC pollution and health' study, a GIS-based noise model has been developed to produce estimates for relevant exposure periods for the cohorts under study. Aims 1) Develop and evaluate a new road traffic noise model for London. 2) predict noise levels from road traffic at home addresses for the epidemiological studies as part of the TRAFFIC study, and 3) examine potential exposure misclassification by estimating noise at multiple facades (front and back of homes). Methods The model integrates into a GIS, recently available, high resolution data on building heights and geometry, coupled with other high resolution data on road geography, land cover, detailed traffic information for over 60,000 road links within Greater London, and address locations. Within the model, based around the CRTN (Calculation of Road Traffic Noise - UK noise methodology), the "ray path" for each source-receptor noise relationship is intersected with underlying land use and building height data. Noise is calculated, taking account of barriers and reflections, at a spatial precision of 1-metre and noise level resolution of 1dB(A). Results The model computes estimates for various metrics (e.g. LAeq16, Lden) at the residential facade. Preliminary results indicate good comparison with existing noise maps for London. Comparisons with noise measurements are currently being made and will be presented. Conclusions The ability to accurately estimate noise levels at a large number of residential addresses is needed to support studies exploring the effects of traffic-related pollution on health in urban environments.

Abstract Number	**P-3-07-02**
Presenter	Quentin Tenailleau*, Nadine Bernard, Sophie Pujol, Daniel Joly, Helene Houot, Frederic Mauny
Exposure	noise
Health domains	no health domain
Type of research	exposure modeling

Assessing environmental noise exposure: does the size of the neighbourhood matter?

In environmental epidemiology, studies rely on the quantification of subject'sexposures in a surface defined as the subject exposure area. For outdoor exposure, this area is often considered as the subject's neighbourhood. But, depending on the authors, the size and the nature of this neighbourhood differs, making difficult to compare results. In order to study the impact of the sampling surface on the noise exposure values affected to a subject, a high definition environmental noise model has been builton a middle-sized French city. Outdoor neighbourhood noise indices were computed at 10,394 residential buildings, using eight different sizes of buffers defined by different radius values: 50m, 100m, 150m, 200m, 250m, 300m, 350m and 400m. For each buffer, noise indices correspond to the average noise level in the buffer's area, in LAeq24h. Results were first compared using Friedman's test. Post-hoc pairwise comparison were then conducted using Wilcoxon test and Siegel & Castelanne adjusted P-values. Indice differences between the smallest and the biggest size of buffer were compared for each building by subtracting 50m buffer noise indice to 400m buffer noise indice (Δ400-50=LAeq24h-400m – Laeq24h-50m). Influence of urban environmental factors (distance to main noise source, urban morphology and deprivation index) was analysed using a multilevel modelling. The means of the eight indices range between 49.0 dB to 49.4 dB, despite samples appears to be significantly different ($P<0.05$). The Δ400-50 values ranges between -16.1 dB to +16.9 dB, and are significantly associated with urban environmental factors (All $P<0.01$). The size of the sampled surface does not seem to influence the estimated average noise exposure. However, for each building, the size of the neighbourhood seriously influence the estimated values. The environmental composition also appears to be of important contribution and should be carefully considered in the choice of the neighbourhood size.

Abstract Number	**P-3-07-03**
Presenter	Ta-Yuan Chang*, Rob Beelen, Su-Fei Li, Bo-Ying Bao, Chiu-Shong Liu
Exposure	noise
Health domains	cardiovascular disease
Type of research	cross-sectional study

Frequency components of measured road traffic noise and the prevalence of hypertension in Taichung, Taiwan

Background Epidemiological studies have reported the association between hypertension and road traffic noise exposure, but the association between noise frequency characteristics is unclear. Aims This study investigated the association between exposure to different frequency components of road traffic noise and the prevalence of hypertension in central Taiwan. Methods We recruited 820 residents living near main roads for more than 3 years. Frequency components of traffic noise and traffic flow rates were measured simultaneously in 2008. Multiple logistic regressions were conducted to estimate odds ratios (ORs) for hypertension, adjusting for potential confounders. Results The high-exposure group (³ median value) at 63 Hz, 125 Hz and 1000 Hz had ORs for hypertension of 2.14 (95% confidence interval [CI]: 1.06-4.31), 2.51 (95% CI: 1.21-5.21) and 1.99 (95% CI: 1.01-3.93), respectively, compared to the low-exposure group (< median value). There was an increasing trend in the prevalence of hypertension by exposure to road traffic noise at 63, 125 and 1000 Hz in all subjects and in men. Subjects exposed to ³ 51 decibels (dB) at 125 Hz had an OR of 3.59 (95% CI: 1.23-10.45) compared to those exposed to < 47 dB. Conclusions Exposure to road traffic noise at low and medium frequencies may be associated with hypertension, and exposure to noise at 125 Hz may have the largest effect on hypertension.

Abstract Number	**P-3-07-04**
Presenter	How-Ran Guo*, Cheng-Yu Lin, Yen-Cheng Tseng, Der-Chung Lai
Exposure	others
Health domains	neurodevelopment
Type of research	cross-sectional study

Gender and geographic differences in the prevalence of childhood hearing impairment: Analysis of data from the national disability registry of Taiwan, 2004-2010

Background: Childhood hearing impairment (CHI) is a major developmental disability, but data at the national level are limited. In Taiwan, the governmentmaintains a registry of certified cases receiving disability benefits, which provides a rare opportunity for studying CHI at the national level. Aims: Using the registry, we conducted a study to estimate the prevalence of CHI by age, gender, and geographic area and to assess changes over time between 2004 and 2010. Methods: We obtained data on CHI cases under 17 years old. According to the criteria for receiving the benefits, a case should have a measured, unaided, pure-tone hearing impairment at frequencies of 0.5, 1 and 2 kHz in the better ear averaging 55 decibels or more and be confirmed as having CHI by an accredited otolaryngologist. In malingering or difficult-to-test cases, auditory brainstem response is used to evaluate the function of the auditory nerve. Results: From 2004 to 2010, registered cases decreased from 4075 to 3533, but changes in prevalence were small, ranging from 7.62 to 7.91 per 10000, without a significant time trend.The prevalence increased over the years in the age groups < 3 years, 3-5 years, and 6-11 years ($p < 0.05$), from 2.26/10000 to 3.99/10000 in the < 3 years group in particular, but decreased in the 12-14 years and 15-17 years groups ($p < 0.05$). The prevalence increased constantly with age each year ($p < 0.05$ in all years). Boys had higher prevalence than girls in each year, and the prevalence rate ratio ranged from 1.07 to 1.11 ($p < 0.05$ in all years)without a significant time trend. Rural areas had higher prevalence than urban areas in each year, and the prevalence rate ratio ranged from 1.01 to 1.09, also without a significant time trend. Conclusions: In Taiwan, the prevalence of CHI was higher in boys and in rural areas. The prevalence in the < 3 years group had increased while the overall prevalence under 17 years old had little changes, indicating a trend of early diagnosis.

Abstract Number	**P-3-07-05**
Presenter	Tara McAlexander*, Richard Neitzel, Robyn Gershon
Exposure	noise
Health domains	other
Type of research	exposure measurement

Geographic and temporal variability in noise levels in New York City

Background: Noise is an understudied exposure in the urban environment with significant implications for human health. Road and street associated noise levels in urban environments, such as New York City, NY (NYC), have a spatial distribution; however, the extent to which this distribution varies with time of day, traffic conditions, and within and between city boroughs is not well understood. Aims: To identify and understand temporal variability in noise levels in NYC, and to understand geographic variation of noise levels in NYC related to environmental characteristics, such as traffic level. Methods: We measured short-term (10 min) noise levels at 35 outdoor (street) sites in NYC between June and August, 2010. Twenty of these sites were in Manhattan and sampled at four times of day: early morning, late morning, early afternoon, and late afternoon. Ten sites were sampled in each of the outer boroughs of NYC: the Bronx, Brooklyn, and Queens. Five sites were sampled in Staten Island, due to its relatively lower density of roads and mass transit. Outer borough sites were sampled at two times of day, morning and afternoon. Differences in noise levels by time of day, borough, and traffic level were tested for significance with t-tests and ANOVA. Results: The mean street/road noise levels were and 74.7, 67.5, 68.8, 70.5, and 70.5 dBA for Manhattan, the Bronx, Brooklyn, Queens, and Staten Island, respectively. For comparison, human hearing can be harmed by extended exposures above levels as low as 70 dBA. ANOVA results indicate that there were significant differences in noise levels by time of day categories, traffic level, and borough. For all boroughs, the noise levels for high, medium, and low traffic level samples were 77.2, 73.8, and 68.4 dBA, respectively. Conclusions: Noise levels in NYC vary by time and space and are likely related to traffic volume. Understanding the variations in noise levels through time and space can help city and transportation planners design strategies to best reduce ambient noise exposure.

Abstract Number	**P-3-07-06**
Presenter	Carmelo Perez-Alvarez, Thomas Steffens, Angelika Zirngibl, Gabriele Bolte, Hermann Fromme, Dorothee Twardella*
Exposure	noise
Health domains	other
Type of research	cohort study

Listening behaviour among adolescents using personal music players and hearing status

Background: The popularity of personal music players (PMP) has caused a growing concern regarding the harmful effects on the hearing status. However there is still a lack of data on the association between PMP usage and noise-induced hearing threshold shifts (NITS). Aims: One of the aims of the cohort study “Ohrkan”, funded by the Bavarian Ministry for the Environment and Health, was to describe the use of PMPs in adolescents and to determine its association with NITS. Methods: The participants were recruited from schools in the city of Regensburg, Germany, during the academic year 2009/2010 or 2010/2011. All students visiting the 9th grade were eligible for participation. Data on usage of PMP were collected via standardized questionnaires from students. Equivalent sound level for 40 hours per week was estimated for each participant based on self-reported duration of use and the level of volume control and compared with lower (80 dB(A))and upper (85 dB(A)) exposure action levels of the European occupational safety standards for noise exposure. NITS was assessed by audiometric testing at the University Hospital of Regensburg. Results: Of the 2.144 participants 85 % were PMP users. Thirtytwo percent of the PMP users exceed the lower and 22 % the upper exposure action values. NITS is slightly more prevalent, but not significantly, in users exceeding exposure action levels (($\geq$ 80 dB(A): OR = 1.13, 95% CI = 0.56, 2.30; $\geq$ 85 dB(A): OR = 1.48, 95% CI = 0.69, 3.15). Conclusions: Our data indicate that the majority of the PMP users at age 15-16 years do not show a harmful listening behaviour. However, still one-fourth to one-third use their PMP in a way that may increase their hazard for acquiring hearing loss in the future. Follow up studies of the cohort will allow examining how the hearing status will develop over time in these young people and thus permit a more valid analysis of the association between PMP usage and NITS.

Abstract Number	**P-3-07-07**
Presenter	Susan Marie Viet*, Michael Dellarco, Maire S.A. Heikkinen, Pabitra Josse, Michelle Lee
Exposure	others
Health domains	other
Type of research	others

Measurement of Noise and Physical Activity in the US National Children's Study

Background. The National Children's Study (NCS) is a longitudinal study that will prospectively investigate the influence of biological, environmental, genetic, and social factors on the health and development of US children. Two measures which pose special challenges are assessment of noise exposures and physical activity. Noise may be assessed by questionnaires, area or personal sound level measurements, or modeling. Similarly, physical activity may be measured by questionnaires, personal accelerometry measurements, with or without GPS, and modeling. Aims. Various approaches to noise and physical activity assessment are being evaluated for feasibility, acceptability, and cost in the Vanguard pilot phase of the NCS. Methods. Based on review of noise and physical activity measurement approaches used in other studies, candidate methodologies were selected for small pilot tests. For noise, a sound level meter, a dosimeter, and a computer loaded with a sound measurement application were placed in two rooms in nine homes with a young child for seven days. A noise questionnaire and source log were also completed. In a separate study, for physical activity, a wrist-worn accelerometer and GPS unit were placed on children at the 48-month visit for seven days along with completion of a time-place-activity log. Results. For noise, daily and weekly average and peak sound levels, by frequency, are being compared between equipment type, rooms, and homes, as well as by home type and participant measures of noise annoyance. Physical activity monitors and log are being evaluated for operational issues and acceptability for use with 4-year olds. Conclusions. The results of the pilot tests on noise and physical activity measures will be used to develop procedures for implementation in the NCS Vanguard phase. In the future, procedures will be developed for pregnant women and older children.

Abstract Number	**P-3-07-08**
Presenter	Luc Dekoninck*, Dick Botteldooren, Luc Int Panis
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Mobile noise measurements as a proxy for BC exposure: spatiotemporal and spatial analysis

Background Personal exposure to traffic related particulate matter is strongly related to the person's activity pattern and in-traffic exposure. Measuring the personal exposure is invasive for the subjects and expensive in both equipment and support costs. The spatial and temporal variability of Black carbon exposure is much stronger than for PM10 and PM2.5 and shows similar spatial effects as the mobile noise measurements. Aims The aim is to enhance diurnal exposure prediction by using mobile noise measurements and the derived local traffic dynamics as a proxy for in-traffic Black Carbon (BC) exposure. Mobile noise measurements contain interesting data on traffic characteristics and are cheaper to perform and require less support. Methods We first constructed a spatiotemporal model for bicyclists including instantaneous wind speed and traffic dynamics. Next a spatial model, aggregating mobile measurements over a one year period is build to investigate the effects of local traffic dynamics, local features of bicycle facilities and the long term meteorological corrections. Results A strong correlation has been established between the mobile noise exposure and the BC exposure of bicyclists. The bicyclists' spatiotemporal prediction model reaches an average trip exposure correlation of 0.86. In the long term spatial model the meteorological effects fade out when sufficient measurements are available. The mobile noise measurement increases the quality of the prediction of the spatial variation of BC exposure significantly compared to models that use only traffic data as primary input. Conclusions Mobile noise measurements can be used as a proxy for BC to map cities at an unprecedented spatial resolution, including the actual local traffic dynamics effects. After correcting the BC exposure for background concentrations, the mobile noise measurements are a valid proxy for personal BC exposure.

Abstract Number	**P-3-07-09**
Presenter	Anja zur Nieden*, Rolf-Hasso Bödeker, Susanne Harpel, Azita Lengler, Ulrich Möhler, Dirk Schreckenberg, Andreas Seidler, Steffen Unkel, Thomas Eikmann
Exposure	noise
Health domains	cardiovascular disease
Type of research	others

NORAH Study: Blood Pressure Monitoring using telemedicine - design and methods

NORAH (Noise Related Annoyance, Cognition and Health) is a monitoring program on transportation noise in the vicinity of Frankfurt Airport. It includes three work packages on noise annoyance, health related quality of life (HQoL), cardio-vascular health diseases of adults, and cognition and HQoL in children. Cross-sectional, case-control and longitudinal sub-studies with a wide range of methods for the assessment of the transportation noise effects in adults and children are applied: Interviews, psychological tests, physiological measurements, and secondary data analysis combined with a case-control study. The monitoring program for blood pressure (BPM) is designed as a longitudinal study (phase one in 12/13, follow-up 13/14) aiming to analyze, whether blood pressure (averaged over measurements within 14 consecutive days out of 21-day-period) as well as the risk of cardio-vascular diseases in total is associated with aircraft noise exposure, road traffic and railway noise and whether the changes in the flight operations due to the airport expansion correspond with changes in the average blood pressure over time. Participants (n=2000) are trained to assess their blood pressure in the morning and evening on 21 days. In addition, they fill in a questionnaire on cardio-vascular risk factors at the beginning of the measurements. The same participants are asked to repeat this measurement in the follow-up one year later. The devices used for measuring blood pressure are fitted with an integrated Bluetooth module, which wirelessly sends the measured values to a cell phone, that in turn forwards the received values (real time) to a secure online database, using a protected internet connection (SSL encryption). Medical staff is monitoring the values to ensure frequency of the measurements and giving feedback to participants. The NORAH Study will be carried out from 2011 to 2014 by commission of the Envi- ronment & Community Center / Forum Airport & Region, Kelsterbach, Germany.

Abstract Number	**P-3-07-10**
Presenter	May Irina, Zaitseva Nina*
Exposure	noise
Health domains	other
Type of research	cross-sectional study

ON THE PREVALENCE OF THE NERVOUS, CARDIOVASCULAR AND HEARING DISEASES IN POPULATION LIVING NEAR THE LARGE AIRPORT

Background/aims: There are numerous data on the effect of noise on the state of human health. Quantitativeparametersoftheconnectionisnotenough. Aim was to assess the impact of noise levels on the nervous, cardiovascular systems and hearing. Methods: we conducted a cross sectional study during 2009-2012, measured the levels of noise in two residential areas, located near a major Russian airport (1 and 3-5 km from airport; 26,0 and 84,0 thousand inhabitants) and in «calm» zone (more then 7 km from airport, 78 thousand inhabitants). We analyzed data from seeking medical care given places of living. The calculation of relative risk of health problems have been done. Using audiometry metod evaluated the level of hearing loss in children from different zones. Results: The average equivalent noise level, recorded in investigated zones at 63,6 ± 6,02 to 66,57 ± 7,25 dB. Maximum sound levels - at 73.5 to 90.0 dB. On «calm» zone equivalent noise level was 59.2 dB, 72.7 dB maximum. The relative risk for residents of zones 1 and 2 in a disease of the nervous system (nervousness, irritability, sleep disturbances, cognitive impairment et.) was 1.92 (CI 1.32-2.65, EF 41.2%), the circulatory system (blood pressure nonspecific, hypertensive disease et.) - 1.1 (CI 1.06-1.44, EF 26.2%). In 2009 – 2011 the cases of conductive and sensorineural hearing loss were recorded only in adult population 18-50 years living near airport (0.19‰). RR in population older than 50 years at zone 1 recorded 2.78 (CI 1.94-3.27, EF 62,3%); at zone 2 - 1.11(CI 1.05- 1,68, EF 22,9%). In investigated group hearing level was lower from 1.0 to 7.0 dB that in control group mainly at frequencies 125-1500 Hz. The most significant reduction hearing was registered in children from areas of greatest acoustic discomfort. Conclusion. In the territories, the approach to the airport some health problems are associated with the level of noise. Health disorders begin in childhood and are exacerbated with age.

Abstract Number	**P-3-07-11**
Presenter	Karin Sygna, Gunn Marit Aasvang, Geir Aamodt, Bente Oftedal*, Norun Hjertager Krog
Exposure	noise
Health domains	mental health
Type of research	cross-sectional study

Road traffic noise exposure, sleep quality and mental health

Background Noise is the environmental factor affecting the largest proportion of the Norwegian population and road traffic is the main source of noise annoyance. There is some evidence that environmental noise may be associated with milder psychological conditions, and some, but diverging evidence of an association with anxiety and depression. Further, there is a well acknowledged interrelationship between sleep quality and mental health. Although poor sleep quality has been defined as a component of mental disorders, some studies indicate that sleep disturbances may be an independent risk factor for reduced mental health. Sleep disturbances may also occur due to environmental noise. Thus, sleep quality may be a mediating factor in the relationship between environmental noise and mental health. As far as we know, no studies have examined the role of sleep quality in the association between traffic noise and mental health. Aims The aim of the study was to examine the relationships between road traffic noise, sleep quality and psychological distress among inhabitants in Oslo. Methods The study was based on a survey on noise and health outcomes conducted in 2000 (n=2459). The road traffic noise exposure (day-evening-night level, Lden) of the subjects was calculated at the most exposed façade of the home address. Mental distress (Hopkins Symptom Checklist) was measured along with somatic health, sleep quality, noise sensitivity and socio-economic variables. Multivariate regression analyses were conducted, adjusted for other risk factors and stratified by sleep quality. Results We found a higher percentage of people with poor sleep quality in the highest noise category compared to the least exposed. A relationship between road traffic and reduced mental health was found only among subjects with poor sleep quality. Conclusions An association between noise exposure, sleep quality and mental health was found. However, further studies are needed to disentangle causal mechanisms.

Abstract Number	**P-3-07-12**
Presenter	Karin Sygna, Gunn Marit Aasvang, Geir Aamodt, Bente Oftedal, Jorunn Evandt, Norun Hjertager Krog*
Exposure	noise
Health domains	no health domain
Type of research	cross-sectional study

Social inequalities in road traffic noise exposure

Background It is well known that there is a social gradient in health. It is not a single explanation of social inequalities in health, but housing seems to be an important factor. In order to prevent health inequalities, it is a need of insights into the social gradient of risk exposure related to housing and residential location. Traffic noise has been associated with negative health conditions such as sleep disturbances, psychological distress, and cardiovascular outcomes. Previous studies have shown contradicting results about noise exposure and socioeconomic status. Aims There is a lack of studies that focus on the social inequalities associated with road traffic noise despite its potential health effects. The aim of the study was to examine how socioeconomic status is linked to exposure of residential road traffic noise, for both individuals and neighbourhoods. Methods This study is a large population based study, using data from the Oslo Health Study (HELMILO, 2009-10), Statistics Norway and modeled estimates of residential noise exposure (Lden). Several variables were included to reflect the dimension of socioeconomic status (SES) of the individual and neighborhood. Association-analyses and log-linear models were used to investigate the intrinsic interaction between the different SES variables for both levels. The study included 10762 and 11813 respondents in the individual and neighborhood SES analyses, respectively. Results We found significant differences in residential noise exposure among individuals and neighborhoods with certain socioeconomic characteristics. Conclusions The results demonstrate social inequalities in exposure to road traffic noise in Oslo, both at individual and contextual levels. Thus, noise exposure might contribute to enlarge social inequalities in health. Further research should investigate whether socially disadvantaged groups show more severe health effects due to noise.

Abstract Number	**P-3-07-13**
Presenter	Simon Thomas*, Surianarayanan Mahadevan, Asit Baran Mandal
Exposure	noise
Health domains	healthrelated quality of life
Type of research	occupational study

Thermal and Noise Stress Levels in Pre-Tanning Operations of

Introduction Leather manufacturing is predominantly done in various developing countries such as India, Vietnam, Pakistan and Ethiopia. Most of these industries are small and medium enterprises that are not exposed to modern manufacturing methods and standards followed in the large enterprises. The study consisted of 10 different tanneries of medium size around Tamilnadu, southern India. These tanneries process raw skin to the semi finished stage. The study aimed at measuring the noise and thermal stress levels at these tanneries in two different seasons of the year summer (April- June) and winter (November-January). Method The heat study was carried out with a QUEST thermal environment monitor and the noise level was measured using a cygnet noise level meter (Type 1 precision grade). The data was collected at an interval of every 15 minutes for three hours for the various operations in the tanneries. Results The heat data collected did not show any significant variation with respect to the location or the operation in the different tanneries in a particular season. The WBGT index varied from 24.3 to 27.7 during the winter and from 28.8 to 33.4 considerably during summer. The noise levels (Leq) highest measured value was between 82.4dBA to 85.3dBA. Conclusion The trends of the heat stress varied in tanneries in both seasons and the hotter zones varied with the ceiling levels and atmospheric temperature and not necessarily due to the machine heat. The study on heat related health effects are underway. The noise levels where found to be not varying much between the seasons except for a small change due to the prolonged use of the generators during the summer. The noise levels were almost close to the permissible level and were found to be higher during the fleshing and drum operation. A well defined, designed and properly segregated workplace arrived upon after a careful and considerate study will help in reducing the heat and noise effects on the workers.

Abstract Number	**P-3-07-14**
Presenter	Lubica Argalasova-Sobotova, Jana Jurkovicova*, Zuzana Stefanikova, Jana Babjakova, Katarina Hirosova, Ludmila Sevcikova
Exposure	noise
Health domains	other
Type of research	cross-sectional study

Time Trends of Environmental Noise Exposure Risks in the Urban Area

Background and aims In Slovakia, the rapid development in traffic density connected with the economic transformation since 1990 has brought new problems in relation to environmental noise, particularly road traffic noise. The aim of the study was to follow the time trends of noise annoyance and interference with human activities in Bratislava agglomeration at different time intervals (10, 15, 20, 25 years). Methods We used the validated methodology for the subjective assessment of "annoyance" and interference with activities, as well as the objectification of noise levels by sound level analyzer with a module for frequency analysis. Our respondents were university students, representing a homogenous sample of young healthy individuals. Results Based on the results of noise exposure measurements in the exposed and control site, we found the continuous increase in traffic noise burden in the exposed area at the intervals of 10, 15 and 25 years beyond the health risk zone. Subjectively, we observed a sharp increase of value risks causing road traffic noise annoyance and interference with various activities over 10 years (ORMH=2.56 (95 % CI=1.93-3.42) in 1989 and 6.01 (95 % CI=4.97-7.95) in 1999) with slightly decreasing trend at intervals of 15, 20, 25 years (ORMH=3.31 (95 % CI=2.68-4.08 in 2013). Interference with sleep and rest disturbance by road traffic noise has been currently the most important issue (ORMH=3.07 (95 % CI=2.43-3.89). In addition to road traffic noise we observed an increase in noise annoyance from the entertainment facilities (OR= 2.43 (95 % CI=1.96-3.01). Conclusions The contribution of our work is in the analysis of time trends of environmental noise exposure risks. The risks of interference with sleep and rest disturbance by road traffic noise are rapidly growing as well as noise annoyance from entertainment facilities. Road traffic noise annoyance represents a long term problem for municipalities, public health authorities and general public.

Abstract Number	**P-3-07-15**
Presenter	Andrei Pyko*, Charlotta Eriksson, Agneta Hilding, Claes-Göran Östenson, Göran Pershagen
Exposure	noise
Health domains	obesity
Type of research	case-control study

Traffic noise exposure and markers of obesity

Background: There is evidence on adverse health effects, including cardiovascular disease, related to environmental noise exposure. Furthermore, noise exposure may result in annoyance and sleep disturbances as well as increasing saliva cortisol levels, indicating physiological stress. Obesity has been linked to stress, however, no study has focused on the relationship between road traffic noise and obesity. Aim: This study was focused on the association between road traffic noise exposure and markers of obesity, including body mass index (BMI), waist circumference and waist-hip ratio. Methods: The cross-sectional study included 4791 men and women living in six municipalities in Stockholm County during 2002-2006. Long term exposure to road traffic noise was estimated based on geographical address coordinates and digital noise maps. Questionnaires and clinical examinations provided information on outcomes and confounders. We used linear regression to assess statistical associations and adjusted the results for individual as well as area-based confounders. Results: Mean BMI in the study population was 26.6 kg/m2 (SD 4.2). Mean waist circumference was 85.0 cm (SD 10.7) and 95.3 cm (SD 9.7) for women and men, respectively. In the full model, adjusted for sex, smoking status, physical activity, education level and alcohol consumption, we found a statistically significant association between road traffic noise and waist circumference, with a 0.8 cm (95 % CI 0.36 to 1.15) increase per 10 dB(A) rise. No clear associations were found for BMI. Conclusions: Our preliminary findings suggest that road traffic noise exposure may affect markers of obesity, in particular waist circumference. This could be of importance for noise induced cardiovascular effects.

Abstract Number	**P-3-07-16**
Presenter	Louis-François Tetreault*, Stéphane Perron, Audrey Smargiassi
Exposure	noise
Health domains	cardiovascular disease
Type of research	review

Traffic related air pollution and noise on cardiovascular outcomes: a systematic review

Objective: This study financed by the National Collaborating Centre for Environmental Health aim of this review was to assess the confounding effect of one traffic-related exposure (noise or air pollutants) on the association between the other exposure and cardiovascular outcomes. Methods: A systematic review of English and French literature was conducted with the bibliographic databases Medlines and Embase. The confounding effects in studies were assessed by using the change in the point estimate with a cut-off point 10%. Results: The literature search yield 180 articles; 9 articles met our selection criteria. For most studies, the modification of the association between traffic-related noise or air pollutants vis-à-vis cardiovascular outcomes produced changes in point estimates lower than 10%. However, the results were inconsistent when assessing the effects on blood pressure, which may underlie the presence of a small confounding effect. Conclusion: The results from this review suggest that important confounding of cardiovascular effects by traffic-related noise or reported air pollutants is unlikely. Studies with a standardized methodology and assessing the effects of specific traffic-related pollutants are needed to properly assess confounding effects.

Abstract Number	**P-3-08-01**
Presenter	Sung-Joon Bae*, In-Yeong Jeong, Kyoung-Bin Lee, Kim Shin-Do, Duck Shin Park
Exposure	others
Health domains	other
Type of research	others

A Study on the Estimation of the Natural Ventilation by Train-Induced Wind in the Subway Tunnel

ABSTRACT As the volume of the road traffic increases, the underground transportation has been focused and developed recently. Especially, the subway is the main transportation system in Seoul as well as in other major cities for public. The environment of subway is not desirable due to its structural characteristics, and it is also exposed to citizens. The examination has been conducted for the air purification system for the management of the subway air quality and Platform Screen Doors(PSDs) installed to prevent pollution by train-induced wind. After installing PSDs, the platform air quality was improved, but the tunnel air quality got worse. Moreover, the aerodynamic effect became bigger when the train runs in the tunnel, but the accurate assessment and analysis are insufficient for the aerodynamic effect. The effect by train-induced wind of the ventilation in the tunnel is significant. So the reasonable and quantitative train-induced wind has to be evaluated and has to be applied to the design stage. This study was aimed to produce useful data for the IAQ(Indoor Air Quality) in subway; especially the train-induced wind has been investigated by means of field surveys and analyses. We carry out the field measurements to quantify the train-induced wind generated by train operation. We found out the quantitative train-induced wind and how the airflow forms by the train arrival and departure. We believe the results from this work will help engineers to understand the airflow in tunnels with PSDs. The recent updates including the quantified characteristics of the train-induced wind will be represented in this paper.

Abstract Number	**P-3-08-03**
Presenter	Li-Ting Lin, Shih-Wei Tsai*
Exposure	household air pollution
Health domains	cancer
Type of research	exposure measurement

Analysis of Airborne Furan Indoors by Solid Phase Microextraction

Background: Furan is a lipophilic and high volatile liquid with low boiling point of 31℃. It may be formed in food under heat treatment, such as the industrial manufacturing and cooking processes. The possible exposure of furan from foods raises concerns because it has been found to cause carcinogenicity and cytotoxicity on animals. Besides, furan is also classified as a possible human carcinogen (Group 2B) by the International Agency for Research on Cancer (IARC) in 1995. Aims: Since furan is formed under heat treatment, it is highly suspected to appear in indoor air. To determine airborne furan, solid-phase microextraction (SPME) technique was utilized as a diffusive sampler while its performances on furan was validated. Methods: SPME fibers, including polydimethylsiloxane (PDMS), carboxen-ploydimethylsioxane (CAR-PDMS) and divinylbenzene/carboxen/PDMS were tested. Known concentrations of furan were generated in gas bags for the evaluations of SPME passive samplers. After sampling, the sampler was inserted into the injection port of portable gas chromatography with mass spectrometer (GC/MS) for thermal desorption and analysis. Results: The results showed that the amounts of furan collected on SPME fiber increased as the concentrations and exposure time increased. Linear relationship was observed after regression analysis, and the sampling rate was determined to be 9.93E-09±1.28E-09 m3/min. Furthermore, side-by-side validations between SPME device and charcoal tube also showed linear relationship with r=0.99. Conclusions: The designed passive sampling device for furan has both the advantages of passive sampling and SPME technique which can be used for monitoring indoor air quality (IAQ) in the future.

Abstract Number	**P-3-08-04**
Presenter	Tong Bou Chang*, Fu-Jen Wang, Meng-Chieh Lee, Chun-Yuan Hsu
Exposure	others
Health domains	other
Type of research	others

Analysis of Energy-saving and Indoor Environment Quality for the Operation Rooms in a Hospital

The heating, ventilating and air-conditioning (HVAC) systems for operating rooms are energy-intensive and sophisticated in that they operate 24 hours per day year-round. The large amount of fresh air with higher air change per hour (ACH) is induced to deal with infectious problems and to dilute microorganisms. However, little quantitative information has been investigated about trade-off between energy-efficient HVAC system and indoor environment quality especially when the operating room was not occupied.The objective of this study is to present the numerical simulation approach for ACH reduction on airflow distribution and contamination control for an unoccupied operating room. Field measurements of operating rooms have been carried out at a district hospital in Taiwan. The compromise of energy-saving potential and indoor environment parameters including pressurization, temperature and humidity, particle counts, microbial counts have been conducted comprehensively. Besides, the energy modeling by eQuest has been applied to evaluate the annual energy consumption while conducting the ACH reduction approach in the unoccupied operating rooms. The results revealed that it is feasible to reduce energy consumption up to 57% (55000 kWh saving) with acceptable variations of indoor environment parameters in the unoccupied operating

Abstract Number	**P-3-08-05**
Presenter	In-Yeong Jeong*, Sung-Joon Bae, Kyoung-Bin Lee, Shin-Do Kim, Duck Shin Park
Exposure	others
Health domains	other
Type of research	others

Analysis of Train-Induced Wind Characteristics in a Subway Tunnel

ABSTRACT As the volume of road traffic in Seoul, South Korea increases, underground transportation use and reach has expanded. Today, the subway system is a popular mode of transportation throughout Seoul. The authors have investigated indoor air quality (IAQ) within Seoul's subway tunnels. Several factors influence the IAQ in a subway tunnel. However, the factor of train-induced wind has not been sufficiently studied, and understanding this factor is important in order to make comprehensive IAQ improvements. The airflow generated by a train entering and running through a tunnel is studied experimentally and numerically with the aim of gaining a solid understanding of the flow in the tunnel geometry and in the configuration with airshafts along the tunnel surface. To analyze the unsteady three-dimensional flow in the underground tunnel caused by the passage of a train, both experimental and computational studies have been conducted. The three-dimensional unsteady numerical analysis using the sharp interface method for the moving boundary of an immersed solid was carried out for the same geometric configurations as the experimental analysis.

Abstract Number	**P-3-08-06**
Presenter	Matti Jantunen*, Katleen De Brouwere, Athanasios Arvanitis, Terry Brown, Christa Cornelis, Derrick Crump, Paul Harrison, Rudi Torfs
Exposure	household air pollution
Health domains	other
Type of research	health impact assessment

Application of the Maximum Cumulative Ratio (MCR) as a screening tool for evaluating mixtures in residential indoor air

Background: Humans are exposed to complex mixtures from multiple sources. Regulatory programs, such as US TSCA and EU REACH generally evaluate risks substance-by-substance. Yet, exposure to mixtures is particularly relevant in indoor air. Aim: To test the applicability of the Maximum Cumulative Ratio (MCR), as screening tool for assessing the risks from European indoor air pollution mixtures. Methods: Hazard quotient of an individual substance (HQi) is defined as concentration (Ci) divided by health based reference value (RVi). MCR is defined as the ratio of ΣHQi of all analysed substances in the mixture divided by max HQi of any individual substance. Indoor Ci data were compiled from the EXPOLIS, OQAI and Flemish IAQ surveys. In deriving the RVs, priority was given to international, recent, science based, peer-reviewed and transparent assessments. The reported indoor air pollution mixtures were divided into 4 categories: - I: max HQi>1, single substance concern - II: HI<1, low concern - IIIa: MCR<2, HI>1, max HQi<1, mixture concern dominated by one substance - IIIb: MCR>2, HI>1, max HQi<1, mixture concern Results: To assess the impacts of the inconsistencies in input Ci and RV data, sensitivity analyses were made using different substance lists and different RV selection criteria. In general the findings of the four categories were robust to the identified sources of uncertainty. In the 3 residential indoor air datasets assessed 3…25% of the individual samples belonged to group I, 53…89% to II, 3..13% to IIIa and 6…13% to IIIb. Conclusions: This work demonstrates the applicability of the MCR as screening tool for indoor air risks. Most of the monitored indoor air mixtures were of low concern, less than 1/3 of concern for mixtures but not for any particular single compound and up to 1/4 of single substance concern. Acknowledgement: Project funded by Cefic LRI contract LRI MIAT -4-VITO

Abstract Number	**P-3-08-07**
Presenter	Ellen Wells*, Donald Moore, Marcia Nishioka, Jeno Mozes, Kenneth A. Loparo, Stuart Greenberg, Dorr G. Dearborn
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Development of a low-cost, real-time, telemetric, continuous residential indoor air quality monitoring system: progress and lessons learned

Background: Short-term fluctuations in indoor air quality (IAQ) may be important for respiratory health; however, continuous IAQ monitoring is rarely assessed in residential settings. Barriers include cost and logistics. Aim: Development of a low-cost residential IAQ monitoring system with continuous, telemetric data transmission for 2 studies: Deep Green and Healthy Homes; National Children's Study Remote Sensing Technology. Methods: A multidisciplinary team assembled IAQ monitors combining low-cost gas sensors with a wireless cellular radio. Calibration equations incorporating data from multiple sensors were developed for each system-gas combination. Additional data were used to assess accuracy. Monitors transmit data every 30 seconds; 62 systems were deployed for 1 year. An internet application (app) was developed to display real-time data. Results: The compact system measures temperature (T), relative humidity (RH), carbon dioxide (CO2), carbon monoxide (CO), nitrogen dioxide (NO2), total hydrocarbons (tVOC), and particulate matter (PM) (0.5-2.5 µm & 2.5-10 µm). T, RH and PM used manufacturer calibration. Individual gas sensors were highly variable. Calibration against gold standard instruments, using 70 environmental chamber test conditions, resulted in the following differences between measured and estimated values (N=16): CO2, ppm: 26.7 (robust standard error: 7.8); CO, ppm: 0.5 (0.2); NO2, ppb: 21.5 (3.5); tVOCs, ppb: 5.7 (5.6). For budgetary reasons, N=47 units were 'tuned' against portable field instruments. Differences for this method were: CO2, ppm: 7.44 (4.96); CO, ppm: -0.02 (0.01); tVOCs, ppb: 17.01 (6.39); however, only one test condition was used. The app facilitates real-time data visualization and equipment diagnostics. Quality assurance field testing data are currently being analyzed. Conclusions: This system is feasible and may be a valuable resource for IAQ assessment in future studies.

Abstract Number	**P-3-08-08**
Presenter	Yuki Nagaoka*, Yoshika Sekine, Takahiro Ozano, Emu Kimura
Exposure	organic compounds
Health domains	healthrelated quality of life
Type of research	others

Effect of physical and chemical properties of manganese dioxide on the oxidative decomposition of formaldehyde at room temperature

Patients, who are suffering from idiopathic health disorders caused by exposure to indoor air pollutants require urgent helps and a simple technology for immediate risk reduction. Manganese dioxide (MnO2) is practically used for a major ingredient of air cleaning materials, because it reacts with harmful formaldehyde to give stoichiometrical carbon dioxide even at room temperature. However, its reactivity had not been fully investigated from a view point of material science. This study then aimed to correlate physical and chemical properties of MnO2 samples on the oxidative decomposition of formaldehyde for the further development of air cleaning materials with higher performance. Six kinds of MnO2-based samples were prepared with different crystalline structure (alpha, gamma, epsilon, amorphous), BET surface areas (161 – 276 m2/g), chemical composition and other accompanying properties. A breakthrough test was conducted on the various MnO2 samples using a glass column coupled with a stream of 500 ppm of formaldehyde gas balanced by air. As a result, alpha and gamma type MnO2 samples significantly showed higher removal efficiency of formaldehyde in the air stream. BET surface area of the powder also contributed to the efficiency. Mass balance tests were also carried out using a closed bag system with 500 ppm of formaldehyde generated from diluted formalin or paraformaldehyde. While all of the samples showed complete oxidation to CO2 at 298 K within 3 hours, one sample (alpha type with certain impurities) specifically showed conversion rate to CO2 greater than unity, when the formaldehyde gas was produced from formalin. This was probably because the sample also decomposed methanol or methanol derived species originated from the formalin. These results lead a conclusion that crystalline structure and chemical properties of synthesized MnO2 samples strongly correlated with reactivity with formaldehyde and reaction pathway.

Abstract Number	**P-3-08-09**
Presenter	Berhe Sahle*, Yemane Alemayehu, Tesfay Gebregiziabiher
Exposure	others
Health domains	cardiovascular disease
Type of research	time series study

Emerging chronic non-communicable diseases in rural communities of Northern Ethiopia: evidence using population-based verbal autopsy method in Kilite Awlaelo su

Introduction: In countries where most deaths are outside health institutions and medical certification of death is absent, verbal autopsy (VA) method is used to estimate population level causes of death. Methods: VA data were collected by trained lay interviewers for 409 deaths in the surveillance site. Two physicians independently assigned cause of death using the International Classification of Diseases manual. Results: In general, infectious and parasitic diseases accounted for 35.9% of death, external causes 15.9%, diseases of the circulatory system 13.4% and perinatal causes 12.5% of total deaths. Mortalities attributed to maternal causes and malnutrition were low, 0.2 and 1.5%, respectively. Causes of death varied by age category. About 22.1, 12.6 and 8.4% of all deaths of under 5-year-old children were due to bacterial sepsis of the newborn, acute lower respiratory infections such as neonatal pneumonia and prematurity including respiratory distress, respectively. For 5–15-year-old children, accidental drowning and submersion, accounting for 34.4% of all deaths in this age category, and accidental fall,accounting for 18.8%, were leading causes of death. Among 15–49-year-old adults, HIV/AIDS (16.3%) and tuberculosis (12.8%) were commonest causes of death, whereas tuberculosis and cerebrovascular diseases were major killers of those aged 50 years and above. Conclusion: In the rural district, mortality due to chronic non-communicable diseases was very high. The observed magnitude of death from chronic non-communicable disease is unlikely to be unique to this district. Thus, formulation of chronic disease prevention and control strategies is recommended.

Abstract Number	**P-3-08-10**
Presenter	Yoshika Sekine*, Hidenobu Furukawa, Kazuyo Takahashi, Shiro Ikeda
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Emission of ammonia from human skin and its impact on indoor air quality

Ammonia is one of the members of odor gases and is a possible source of odor to neighboring persons in indoor environment when emanating from human body surface. However, little has been known on the actual emission rate of ammonia from the skin surface. This study then aimed to determine influence of ammonia from human skin on the indoor air concentration levels. Authors practically measured emission flux of ammonia from human skin of 29 volunteers by originally-developed passive flux sampler - indophenol blue methodology. Ammonia was passively collected by a trapping filter of the sampler for 1 hour, extracted by borate solution with a mild shaking and then determined by spectrometry. The emission flux was then derived from collection amount of ammonia within 1hour and area of skin surface covered by the sampler. Using the emission flux data, indoor diffusion concentrations were estimated by Near-Field Far-Field zones model. The near field was set as a hemispherical space with 60 cm of radius (corresponding to the length of arms) and a person (odor source) was assumed as a point source. The results showed estimated near field concentration of ammonia, ranging from 42 – 529 µg/m3 (mean: 52 µg/m3) was too low to perceive the odor by neighboring persons in most cases. However, the emission flux of ammonia significantly increased, when the volunteers were exercising with sweating, and the mean near-field concentration became 1.7 times greater than those at rest. In the latter case, most of concentration levels were enough to perceive the slight odor of ammonia by neighboring persons. These results lead a conclusion that odor intensity of ammonia emanating from skin depends on physical and/or physiological conditions of a person in indoor environment.

Abstract Number	**P-3-08-11**
Presenter	Aude Vesin, Philippe Glorennec*, Barbara Le Bot, Henri Whortam, Nathalie Bonvallot, Etienne Quivet
Exposure	household air pollution
Health domains	neurodevelopment
Type of research	exposure measurement

EVALUATION OF TRANSFLUTHRIN INHALATION EXPOSURE DURING THE APPLICATION OF ELECTRIC VAPORIZERS INDOORS.

Background. The increasing application of commercial household insecticides in indoor atmospheres is raising questions due to the potential hazardous properties of the active substances, since both exposure level and duration to those chemicals are likely to be significant. Aims.This study intends to evaluate the inhalation exposure to transfluthrin during the application of electric vaporizers. Methods. Different household insecticide applications via two electric vaporizers emitting transfluthrin were realized in a full-scale experimental room under controlled air exchange rate (AER) conditions. On-line high-time resolved measurements of the gaseous concentrations of the active substance during and immediately after the spreading periods were performed with a High Sensitivity Proton-Transfer-Reaction Mass Spectrometer (HS-PTR-MS). The average inhaled concentrations have been estimated for different exposure durations. Results.Based on experimental data, modelled indoor gaseous concentrations of transfluthrin (8h emission) ranged from 1.7 to 11.0 µg.m-3 for 1 h-1 and 0.14 h-1 AER, respectively. Average inhaled concentrations over 1 h, 1 week, 5 months were estimated to 8.3, 1.8, 1.8 µg.m-3, respectively. Conclusions. Inhalation exposures have been estimated for different exposure scenarios. Corresponding margins of exposures range from 1000 to 10000, claiming for the absence of effect. However, dermal and dust ingestion pathways, although roughly estimated, seems being non negligible. This claims for a more in depth integrated risk assessment.

Abstract Number	**P-3-08-12**
Presenter	Corinne Mandin*, Serena Fossati, Philomena M. Bluyssen, Viktor G. Mihucz, Domenico Maria Cavallo, Eric Cornelissen, Ioannis Sakellaris, Gabriela Ventura, Tamas Szigeti, Rosanna Mabilia, John Bartzis
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

IAQ in modern office buildings in Europe: the OFFICAIR Project

Background. Indoor air quality (IAQ) in modern office buildings is poorly described whereas specific sources emit respiratory tract and eye irritants. Relationships between indoor environment, health and wellbeing of occupants are complex, including a psychosocial component. Aims. The OFFICAIR project aims at improving knowledge on indoor environment in modern office buildings in Europe and its impacts on health and comfort. 167 buildings in 8 countries have been studied via a questionnaire to the occupants on environmental, physiological, psychological and social aspects and a descriptive checklist. A subsample of 36 buildings was selected for an extensive monitoring survey. Methods. The IAQ of the 36 buildings was investigated twice in summer 2012 and winter 2012-2013. Four rooms and one outdoor location were monitored from Monday to Friday. Temperature and relative humidity were measured continuously. Volatile organic compound, aldehyde, nitrogen dioxide and ozone concentrations were measured through passive sampling. PM2.5 concentrations were gravimetrically determined. Workers were invited to participate to on-line anonymous tests to evaluate reactivity, eye irritation and episodic memory, in addition to questions relative to IAQ perception and health symptoms. Results. First results (n=33, summer campaign) show relatively low indoor concentrations of PM2.5 (median: 9.2 µg/m3; range: 5.5-17.5 µg/m3), ozone (6.4; below limit of quantification-40.1), NO2 (2.7; 15.7-28.5), alpha-pinene (2.9; <LOQ-65.8), limonene (4.2; 0.19-33.8) and formaldehyde (14.1; 4.7-48.5). Conclusion. These indoor concentrations need to be studied in association with reported symptoms and test results. Multivariate analyses will make it possible to identify contributors to indoor air pollution and the respective influence of the ventilation system, the outdoor environment, indoor sources, etc. Further field surveys will be performed to complete the data set with samplings on a shorter time-scale, including new compounds.

Abstract Number	**P-3-08-13**
Presenter	Ilse Ruiz-Mercado*, Anaite Díaz, John R. Balmes, Kirk R. Smith
Exposure	household air pollution
Health domains	respiratory disease
Type of research	case-control study

The effect of continued use of open fires on the reductions in household air pollution observed in the Guatemala RESPIRE and CRECER Studies

Background: The RESPIRE and CRECER stove trials investigated the health effects of the exposure to HAP from biomass cooking in the Guatemala highlands. RESPIRE (2002-2004) resulted in reductions of 90% in the kitchen CO concentrations of the chimney-stove intervention group, compared to those using traditional open-cookfires. In the same communities, CRECER (2006-2010) resulted in reductions of only 60% disseminating the same stove design. Aims: Understand the extent to which continued use of the open fire may have contributed to the differences in HAP reductions found in RESPIRE and CRECER. Methods: In RESPIRE, households (269 stove and 265 fire) were visited weekly to perform recall questionnaires of stove and fire use and to observe stove maintenance. In CRECER, household visits occurred quarterly, and stove use was also measured with electronic Stove Use Monitors (SUMs) in a subgroup of 80 homes. We obtained marginal estimates by intervention group of the reported open-fire prevalence and the observed stove maintenance status recorded during both trials. We partitioned the variance components of usage with random effects models. Results: In CRECER high levels of stove use were reported (97%) and measured (92%), and 50% of the households reported prevalent use of an open fire. Animal feed was the most common cooking task performed with the fire (46% of the households) followed by boiling corn for tortillas (25%), space heating (13%), boiling water (11%) and preparing food for the family (11%). These percentages tripled the fire use reported in RESPIRE. 76% of the total variability in SUMs-measured stove use was contributed by between-household differences from the preferences cooking certain tasks with the stove or the fire. Conclusions: Households with high levels of sustained cookstove use can still be exposed to elevated concentrations of air pollutants from the continued use of open cookfires. Quantifying this prevalence and the maintenance of the stoves is critical to improve exposure assessment and to improve the effectiveness of stove

Abstract Number	**P-3-08-14**
Presenter	Jinliang Zhang*, Qin Liu, Ling Liu, Guoliang Chen, Xiujie Fang, Sujuan Xue
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

The effects of daily fuels using on indoor VOCs in rural northern Anhui province

Aims: Tomeasured the influence of biogas, straw, coal, and liquefied petroleum gas (LPG) on the levels of indoor VOCs in northern Anhui province. Methods: We chosen 20 households with the same house structure and completely separated kitchens which had very similar size, ventilation and stoves location. Of them, each 5 households were used the biogas, straw, coal, or (LPG) as the daily fuel. Successively 48h VOCs(including benzene, toluene and TVOCs) in kitchens and bedrooms were collected by Radiello passive diffusion tubes. Results: For benzene, toluene and TVOCs, the highest levels in the kitchens were found in the household with coal combustion, next in the household using straw as daily fuels. The geometric mean of benzene were 552.47μg/m3 for coal using, 268.50μg/m3 for straw, 108.49μg/m3 for LPG and 81.40μg/m3 for biogas; The geometric mean of toluene were 62.11μg/m3,23.01μg/m3, 14.54μg/m3 and 13.57μg/m3; the geometric mean of TVOCs were 454.29μg/m3, 219.33μg/m3, 160.25μg/m3 and 165.23μg/m3. For coal combustion household, the levels of benzene, toluene and TVOCs in the bedroom were much lower than those in the kitchens, while pollutants levels were similar with those in the bedroom for all other fuels. Among all 4 fuels, straw using brought the highest pollution in the bedroom. Conclusions In the study area, there was less impact of daily fuels on the VOCs in the bedroom. The coal combustion brought the greatest impact on the levels of VOCS in the kitchens, while LPG and biogas produced less pollution and were relatively clean fuels. Keywords indoor air quality (IAQ); benzene; toluene; TVOCs

Abstract Number	**P-3-08-15**
Presenter	Konstantin Chernyi*
Exposure	ionizing radiation
Health domains	healthrelated quality of life
Type of research	exposure modeling

The Methodological Approach of Corona Air Ionizer Usage while conducting Correction of Indoor Air Ion Composition

The modification of air ion composition of indoor air causes a feeling of discomfort in the buildings. Corona air ionization is quite often used for artificial indoor air ionization. There is a need of the solution of two inconsistent tasks connected with specifying features of air ionizers technical characteristics as well as their location when using electrical corona air ionizers for correction of air ion composition. On the one hand, to provide the sufficient generating ability of the air ionizer it is necessary to increase the corona voltage or to place it in the area of long-time use. On the other hand, increase of the corona voltage leads to increasing in generation of concomitant harmful chemical compounds. To solve the above mentioned problems the characteristics of air ion composition change were investigated in a laboratory room and chemical contaminants which are produced during the process were identified. Research results of small air ion concentration, air ion mobility spectra and volume concentration of ozone, nitrogen oxides are presented at a different distance and with different corona voltage. Regularities in the ion concentration depending on the distance from the ionizer do not correspond to those obtained by other researchers. A hypothesis explaining the reasons for this discrepancy is proposed. At high corona voltage intermediate air ions with the range of mobility from 0.1 to 0.5 cm2/(V.s) compose significant proportion in the distribution of air ions generated by corona air ionizer. The appearance of intermediate ions in the mobility spectra is explained by the possible formation of new chemicals and aerosol particles from the gas phase in areas of heightened ionization. The received empirical dependences allow to carry out calculating of change of foregoing characteristics for the air ion composition being formed.

Abstract Number	**P-3-08-16**
Presenter	Miyuki Noguchi*, Atsushi Mizukoshi, Akira Nishimura, Yukio Yanagisawa, Akihiro Yamasaki
Exposure	household air pollution
Health domains	other
Type of research	health impact assessment

Toxicity Evaluation of Organophosphate Flame Retardants in terms of Cholinesterase Inhibition

Organophosphate flame retardants (OPF) have been widely used as substitute for polybrominated flame retardants. OPF have been recognized as low level harmful substances based on LD50. However, it is concerned that OPF could cause neurotoxic effects such as cholinesterase inhibition because of the similar chemical structures to organophosphate pesticides. In this study, cholinesterase inhibition of various OPF was measured to assess the neurotoxicity of OPF. The cholinesterase inhibition was measured by the spectrophotometiric method developed by Ellman et al.(1961). Decomposition reaction of butyrylthiocholine chloride (BTCh) by butyrylcholinesterase (BChE) was used for the assessment. Effect of the addition of OPF, namely, tris(2-chloroisopropyl)phosphate (TCIPP), tris(2-chloroethyl) phosphate (TCEP), tris (1,3-dichloro- 2propyl) phosphate (TDCPP) , trisphenyl phosphate (TPP), which are commonly used as building materials, on the decomposition rate of BTCh was investigated. BTCh and the OPF were dissolved in phosphate buffer solution (0.1 M, pH 7.4), and DTNB was added as a color reagent. Then, the decomposition reaction was initiated by adding BChE. The dissociation rate was determined by the measuring the absorbance change at 412 nm wavelength. Cholinesterase inhibition was observed for all the OPF used in this study, which indicates these OPF could have neurotoxic effects. The observed order of inhibition was: TCEP > DDVP > TPP > TDCPP > TCIPP. This order is in accordance with the order of toxicity based on LD50, except TDCPP. Although LD50 of TCEP (1230 mg/kg) is much higher than that of DDVP (250 mg/kg), the degree of inhibition of TCEP is almost similar to that of DDVP. This result suggests that the neurotoxicity of the OPF could be underestimated when assessed in terms of LD50. The assessment based on the cholinesterase inhibition is essential for the evaluation of toxicity of OPF, and useful to select OPF.

Abstract Number	**P-3-08-17**
Presenter	Ryan Chartier*, Myles Elledge, Michael Phillips, Katherine Bronstein, Jonathan Thornburg, Paul Mosquin, Vanessa Thornburg, Sumal Nandasena, Randy Newsome, Charles Rodes
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Validating the Performance of the RTI MicroPEM to Support Indoor Air Pollution Exposure Health Studies

Background The RTI MicroPEM Personal Exposure Monitor was recently developed to measure sized particulate matter (PM) for both personal and indoor exposures, including strong source indoor air pollution (IAP) settings such as cookstove environments. Performance validation data have yet to be summarized to gauge level of readiness and improvement in uncertainty over prior art technologies. Aims Validate data from a combination of domestic and in-country IAP settings to evaluate performance parameters including precision, accuracy, representativeness, data capture rates, and ease of deployment. Utilize data from a 50 residence Sri Lanka cookstove study to determine consistency with these findings. Methods Integrated and real-time MicroPEM data were collected during laboratory, domestic, and in-country deployment settings. Available performance data were compiled, including in-country usability and deployability information, to characterize MicroPEM performance as related to performance goals, as well as to compare to alternative filter and real-time sampling techniques. Results The accuracy of the MicroPEM against a pseudo-referee sampler (MSP PEM) during simulated solid fuel cookstove IAP showed a bias of +3.8% for PM2.5. Collocated MicroPEMs deployed in Sri Lankan homes yielded a relative standard deviation (RSD) of 11.6% for PM2.5. A smaller RSD value of 2.4% was obtained during a domestic (US) exposure study. Ease of deployability led to a valid data capture rate in Sri Lanka that exceeded 97.5%. Conclusions To date, the v3.2 MicroPEM has met all performance goals. Factors such as accuracy, precision, and representativeness are excellent, even when operating in strong source IAP settings. Deployability is simple resulting in valid data capture rates exceeding 97%. In-country testing in Sri Lanka demonstrated the viability for local deployments by modestly trained non-technical field staff. Although a quantitative comparison to a true referee exposure metric is needed, the performance of the MicroPEM in IAP settings was excellent.

Abstract Number	**P-3-08-18**
Presenter	David Galbraith*, Heather Bolstad
Exposure	organic compounds
Health domains	respiratory disease
Type of research	others

Food Flavorings Exposures and Bronchiolitis Obliterans: A Case Series

Workers in industries that manufacture, distribute, and use food flavorings, particularly those containing diacetyl, have been reported to be at increased risk of developing fixed obstructive lung disease, including bronchiolitis obliterans (BO). BO is a rare and progressive lung disease that requires confirmation via biopsy, and is most commonly described in association with transplant rejection. We reviewed health information and occupational exposure histories for 11 workers who reportedly developed BO as a result of occupational exposures to diacetyl and/or other flavorings compounds. Information regarding the workers had been disclosed as part of litigation. The differential diagnoses from various physicians were compared and the strength of evidence regarding the diagnoses was evaluated. We found considerable diversity among the cases with respect to job responsibilities, durations and magnitudes of exposure, the agents to which the individuals were exposed, the clinical diagnoses identified by treating physicians prior to lung biopsy, and the tissue diagnoses provided by pathologists at the treating institutions. The available clinical, radiologic, and pathologic data indicate that these workers suffered from severe asthma, COPD, and hypersensitivity pneumonitis, among other conditions, rather than BO.

Abstract Number	**P-3-11-01**
Presenter	Hillel Alpert, Israel Agaku*, Constantine Vardavas, Gregory Connolly
Exposure	others
Health domains	respiratory disease
Type of research	cross-sectional study

Ambulatory and emergency hospital visits on account of wheezing in children exposed to secondhand smoke in multi-unit dwellings, National Health and Nutrition E

INTRODUCTION: Among the approximately 79.2 million U.S residents in multi-unit housing (MUH), over half with smoke-free homes have experienced secondhand smoke (SHS) infiltration. This study assessed the effect of SHS exposure among children in MUH on wheezing-related hospital visits. METHODS: Data was analyzed from the 2001-2006 National Health and Nutrition Examination Survey for 11,657 non-smokers aged <15 years. Residence/housing was categorized as multi-unit or detached based on attachment to another housing unit. Household SHS exposure was defined as ≥1 smoker in the home. Number of ambulatory or emergency visits in the past year due to wheezing was self-reported. A multivariate Poisson regression model was fitted to assess the effect of household SHS exposure and housing type on hospital visits on account of wheezing, adjusting for pre-existing asthma, general health condition, sex, age, race/ethnicity, household reference-person education, and poverty index ratio. Household SHS exposure-housing type interaction was assessed using the likelihood-ratio test (P<0.05). Data were weighted and analyzed with Stata, version12. RESULTS: Children exposed to household SHS had 1.89 times the rate of hospital visits due to wheezing compared to non-exposed children (P=0.009). The rate of hospital visits among children in MUH was 1.62 times that of children in detached houses (P=0.032). Household SHS exposure-housing type interaction was present (P=0.046). The effect of SHS exposure on hospital visits in children in MUH (Incidence rate ratio, IRR=2.48; 95% confidence interval, CI=1.44-4.28) was higher compared to children in detached houses (IRR=1.12; 95%CI: 0.30-4.22). CONCLUSION: The effect of household SHS exposure on hospital visits due to wheezing was significantly higher in MUH children compared to those in detached housing. Enhanced and sustained efforts are needed to reduce indoor SHS exposure.

Abstract Number	**P-3-11-02**
Presenter	Jai Dong Moon*
Exposure	others
Health domains	cancer
Type of research	case-control study

Association between Parental Smoking and Acute Childhood Leukemia

Association between Parental Smoking and Acute Childhood Leukemia Jai Dong Moon Department of Occupational and Environmental Medicine Environmental Health Center Chonnam National University Hwasun Hospital Background : Several epidemiologic studies have found inconsistent results regarding the association between parental smoking and childhood leukemia. Only paternal smoking, not maternal, has been reported as a risk factor for acute childhood leukemia. Aims : This study was performed to investigate the association of parental smoking with acute childhood leukemia and additionally to evaluate the validity of questionnaire-based exposure assessment as a surrogate of past exposure to smoking. Methods : A case-control study was conducted with 118 acute childhood leukemia cases (81 acute lymphoblastic leukemia and 37 acute myeloid leukemia) and 187 controls aged below <20 years between 2007 and 2011. Smoking-related informations were obtained by trained interviewer using the questionnaire. Blood lead, cadmium and urinary mercury were measured for validation purpose. Results : Mothers who were current smokers or had smoking husband showed statistically significant higher blood cadmium levels than non-smoking mothers (P<0.05). Maternal past smoking history and second-hand smoking were associated with risk of acute childhood leukemia with odds ratios of 5.10 (95% confidence interval (CI) : 1.34, 19.45) and 2.56 (95% CI : 1.36, 4.93), respectively. Paternal current smoking and smoking history before pregnancy were also significantly associated with childhood leukemia with the odds ratios of 1.76 (95% CI : 1.09, 2.86) and 2.12 (95% CI : 1.21, 3.72). Conclusions : These study results strongly suggest that both paternal and maternal smoking may be the risk factors of acute childhood leukemia. Key words: Childhood leukemia; case-control study; maternal smoking; paternal smoking

Abstract Number	**P-3-11-03**
Presenter	Seulkee Heo*, Jina Heo, Jong-Tae Lee
Exposure	household air pollution
Health domains	cancer
Type of research	cross-sectional study

Attributable Risk from Exposure to Second-hand Smoke in Korean Adults in 2009

Background: The disease burden from exposure to second-hand smoke (SHS) has been estimated in various region-specific studies. During the last decade, a large number of studies about the disease burden from active smoke have been conducted in Republic of Korea, but few concerned the impact of SHS. Aims: We estimated the number of deaths attributable to exposure to SHS in Korean adults from lung cancer and ischemic heart disease (IHD) in 2009. Methods: The total number of death from diseases was obtained from The Cause of Death Statistics, 2009. We estimated the SHS-attributable fraction using the data of Community Health Survey, 2009. The number of deaths attributable to SHS was calculated by multiplying the number of deaths in non-smokers and the SHS-attributable fraction. Results: Among total deaths from lung cancer in 2009, 5798 deaths in male (53% of total male deaths from lung cancer) and 283 deaths in female (7% of total female deaths from lung cancer) were attributable to active smoke. For IHD, 1841 male deaths (26% of total male deaths from IHD) and 427 female deaths (7% of total female deaths from IHD) were attributable to active smoke. 261 non-smokers died from lung cancer due to exposure to SHS, with 122 (47%) in men and 139 (53%) in women. 235 deaths in non-smokers from IHD were caused by SHS, with 103 (44%) in men and 132 (56%) in women. The number of deaths caused by SHS in male was estimated to be 2.9% of that caused by active smoke in male. The number of deaths caused by SHS in female was estimated to be 36% of that caused by active smoke in female. Overall, if non-smokers exposed to SHS had the same death rates as non-smokers not exposed to SHS, we would expect to see 496 fewer deaths (5.9% of the deaths caused by active smoke). Conclusions: The results suggest that exposure to SHS posed considerable health problemds for non-smokers, especially for female adult non-smokers in Korea.

Abstract Number	**P-3-11-04**
Presenter	Heike Luttmann-Gibson*, Julie Buring, Georgina Friedenberg, David Gordon, I-MIn Lee, Jo Ann Manson, Diane R. Gold
Exposure	no exposure
Health domains	respiratory disease
Type of research	randomized trial

Baseline cigarette smoking and dusty job exposure associations with COPD and asthma symptoms in theVitamin D and Omega-3 Trial (VITAL)

Background Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. The Vitamin D and Omega-3 Trial (VITAL) is randomizing >22,000 U.S. adults >50 years of age to examine vitamin D and fish oil supplementation effects on cancer and cardiovascular disease development. Lung VITAL will investigate supplement effects on COPD exacerbation, asthma control, and level of lung function. Aims To examine the pre-randomization cross-sectional relationship of cigarette smoking and dusty jobs on COPD manifestations and pulmonary function in Lung VITAL participants. Methods A subset of 5848 study participants enriched for respiratory symptoms completed a baseline respiratory questionnaire. We compared rates of chronic cough, chronic phlegm, dyspnea (Modified Medical Research Council Dyspnea Scale),and wheezing between exposed and non-exposed subjects and used logistic models to adjust for subject demographics. Juniper asthma control score was calculated. For 620 subjects, adjusting for age, height, BMI, sex, and ethnicity/race, we used linear models to examine effects of smoking and dusty jobs on FEV1. Results Former and current smoking rates were 45% and 10% (average pack-years=24.2); 4% had dusty jobs. Wheeze more than once a week, chronic cough, chronic phlegm, dyspnea, and asthma symptoms increased from never to former to current smoking (e.g., wheeze rates were 11%, 13%, 31%) and with dusty jobs (wheeze: 22% vs. 14%, chronic cough: 33% vs. 24%). Compared to no smoking, >30 pack-years of smoking was associated with a decrease of 217 ml (95% CI: 88-346) in FEV1. The odds of any dyspnea were 26% (95% CI: 7-48%) higher for 10-30 pack-years, and 130% (95% CI: 96-170%) higher for >30 pack-years, compared to no smoking, and 60% (95% CI: 22-110%) higher for subjects exposed to dust. Conclusion In this vitamin D and fish oil supplementation trial, baseline dyspnea, wheeze and lung function are adversely influenced not only by smoking, but also by occupation. This work is funded by NHLBI (R01 101932).

Abstract Number	**P-3-11-05**
Presenter	Verena Jürgens*, Silva Ess, Harish C. Phuleria, Martin Früh, Matthias Schwenkglenks, Harald Frick, Thomas Cerny, Penelope Vounatsou
Exposure	others
Health domains	cancer
Type of research	others

Bayesian spatio-temporal modelling of tobacco-related cancer mortality in Switzerland

Background: Tobacco smoking is a main cause of disease in Switzerland; lung cancer being the most common cancer mortality in men and the second most common in women. Although disease-specific mortality is decreasing in men, it is steadily increasing in women. The four language regions in this country might play a role in this context as they are influenced in different ways by the cultural and social behaviour of neighbouring countries. Methods: Bayesian hierarchical spatio-temporal, negative binomial models were fitted on subgroup-specific death rates indirectly standardized by national references to explore age- and gender-specific spatio-temporal patterns of mortality due to lung cancer and other tobacco-related cancers in Switzerland for the time period 1969-2002. Differences influenced by linguistic region and life in rural or urban areas were also accounted for. Results: Male lung cancer mortality was found to be rather homogeneous in space, whereas women were confirmed to be more affected in urban regions. Compared to the German-speaking part, female mortality was higher in the French-speaking part of the country, a result contradicting other reports of similar comparisons between France and Germany. The spatio-temporal patterns of mortality were similar for lung cancer and other tobacco-related cancers. Conclusions: The estimated mortality maps can support the planning in health care services and evaluation of a national tobacco control programme. Better understanding of spatial and temporal variation of cancer of the lung and other tobacco-related cancers may help in allocating resources for more effective screening, diagnosis and therapy. The methodology can be applied to similar studies in other settings.

Abstract Number	**P-3-11-06**
Presenter	Bogumila Szponar*, Christina Pehrson, Lennart Larsson
Exposure	microbial environment
Health domains	respiratory disease
Type of research	exposure measurement

Biological components of tobacco smoke aerosol

Background Cigarette smoke is a major trigger affecting lung health due to toxic substances, many of which may act in synergy. Mainstream smoke typically contains large amounts of bacterial and fungal compounds such as endotoxin (lipopolysaccharide, LPS) and ergosterol. Secondhand smoke is rich in LPS appearing indoors as bioaerosol (1,2). Endotoxin is among the most aggressive compounds known to be able to aggravate i.e. chronic bronchitis, COPD, or asthma and allergy symptoms. Aims We aimed to evaluate the microbial exposure due to secondhand smoke at twelve homes and a worksite. Apart from LPS, which has earlier been identified in secondhand smoke, we also included ergosterol, a chemical marker of fungi. Methods Ergosterol and 3-hydroxy fatty acids were identified in all studied samples of air-borne dust which were subjected to chemical procedures and analytical measurements by gas chromatography-mass spectrometry. Results The tobacco smoke concentrations of the bacterial and fungal markers were significantly higher in rooms with ongoing smoking than in rooms without smoking: the air concentrations of LPS were 0.0017 nmol/m3 and 0.0007/m3 in the smoking vs. non-smoking rooms (p=0.0559) of the private houses, and 0.0231 nmol/m3 vs. 0.0006 nmol/m3 (p=0.0173), respectively, at the worksite. The air concentrations of ergosterol were also significantly higher in rooms with ongoing smoking vs. smoke-free rooms. A positive correlation was found between LPS and ergosterol in rooms with smoking but not in rooms without ongoing smoking. The LPS of mainstream smoke contained 3-hydroxy C14:0 and 3-hydroxy C12:0 in the same proportions as the second hand smoke. Conclusions Research is continued on evaluation of the role of microbiological components in the progression of airways symptoms and diseases associated with tobacco smoking i.e. lung interstitial disease, COPD, and alveolar hypersensitivity. 1. Larsson L et al. 2004. Indoor Air 14:421-424; 2. Szponar B et al. 2012. Sci Total Environ 438: 447-451

Abstract Number	**P-3-11-07**
Presenter	Francesco Barone-Adesi*, Antonio Gasparrini, Lorenzo Richiardi
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	health impact assessment

Cardiovascular benefits of smoking regulations in public places: validation of a mathematical model.

Background: Studies conducted in different countries have reported a reduction in the number of heart attacks after the introduction of regulations banning smoking in public places. We previously developed a mathematical model to calculate the expected amount of this decrease, as a function of different scenarios of exposure to active and passive smoking. Aims: We used published data from England and Scotland to validate our mathematical model. Methods: Reductions in the number of heart attacks observed in England and Scotland after the introduction of a comprehensive smoking ban were contrasted with those predicted by our mathematical model. Data from Information Services Division (ISD) Scotland were used to estimate changes in incidence rates of Coronary Heart Disease (CHD) in Scotland. Results of a large epidemiological study conducted in England were used to estimate the effect of the introduction of the smoking legislation on the rates of hospital admissions for Acute Myocardial Infarction (AMI). The values of the parameters in the mathematical model were derived from the results of population surveys on passive smoking exposure in the two countries. Monte Carlo simulations were used to estimate the uncertainty of the predictions of the mathematical model. Results: the observed reduction in hospital admissions for AMI in England and CHD incidence in Scotland after the introduction of the smoking ban was 2.4% (95% Confidence Interval [CI]: 0.7 to 4.1) and 3.1% (95% CI: 1.5 to 4.7), respectively. The reduction predicted by our mathematical model in the two countries was 1.6% (95% Prediction Confidence Interval [PCI]: 0.7 to 3.1) and 3.6% (95% PCI: 1.3 to 7.5), respectively. Conclusions: The observed cardiovascular effects of the introduction of the smoking legislations in England and Scotland were similar to those predicted by our mathematical model. This suggests that our model can be used to predict accurately the effect of the introduction of smoking regulations.

Abstract Number	**P-3-11-08**
Presenter	Hyunok Choi*, John D. Spengler
Exposure	ambient air pollution
Health domains	cancer
Type of research	exposure measurement

Contribution of Secondhand Smoke and Multiple Outdoor Sources in ?Residential Indoor Polycyclic Aromatic Hydrocarbon Level

Objectives: Extent to which multiple sources contribute to indoor concentrations of individual PAH species is little known within intensive coal-burning regions. Here, we examined the contribution of indoor and outdoor sources on individual species of the airborne PAHs. Methods:Indoor and outdoor concentration of nine common PAHs – benz[a]anthracene, chrysene/isochrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[1,2,3-c,d]pyrene, dibenz[a,h]anthracene, benzo[g,h,i]perylene and pyrene were monitored in 75 homes for 48 hour period across a two-year period in Krakow, Poland. Due to no known indoor sources for pyrene, we used pyrene as a tracer for infiltration of outdoor air. Indoor concentrations of eight PAHs were partitioned to indoor and outdoor source contributions. Results: Relative importance of season-related outdoor sources and secondhand smoke differed for the nine PAH species. In homes reporting ≥5 hours of daily secondhand smoke, median concentrations of benzo[g,h,i]perylene, benzo[a]pyrene, D[a,h]A, and indeno(1,2,3-c,d)pyrene were ≥ 1.7 times higher than outdoors, while median I/O ratios for benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, and chrysene were ≤ 1.5. Using pyrene as a tracer, the outdoor sources contributed to indoor air concentration of benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, and chrysene more substantially (i.e. 2- to 7-times) than did the indoor sources. In contrast, in homes reporting cigarette smoking, the tobacco and outdoor related sources contributed equally for benzo[g,h,i]perylene, benzo[a]pyrene, D[a,h]A, and indeno(1,2,3-c,d)pyrene. Conclusion:Indoor concentration of benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, and chrysene were predominantly determined by infiltrated outdoor PAHs. In contrast, benzo[g,h,i]perylene, benzo[a]pyrene, D[a,h]A, and indeno(1,2,3-c,d)pyrene – species of highest carcinogenic and mutagenic potencies – were contributed not only by the outdoor sources, but also by secondhand smoke.

Abstract Number	**P-3-11-09**
Presenter	Julia Dratva*, Nino Kuenzli, Robert Bettschart, Thierry Rochat, Thomas Rothe, Daiana Stolz, Alexander Turk, Nicole Probst-Hensch, Elisabeth Zemp
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

Early life Exposure to Environmental Tobacco Exposure and Atherogenesis

Background: Early exposure to environmental tobacco smoke (ETS) is associated with adverse health outcomes in children and adolescents: reduced lung function growth, asthma and adverse birth outcomes. Less is known on the impact of early life ETS exposure on cardiovascular health and atherosclerosis, although ETS is considered to be highly atherogenic in adults and remains a prevalent exposure in utero and childhood. Aim: 1. Present the state of knowledge on early life/childhood risk factors for atherogenesis, focusing on early life ETS exposure. 2. Present complexity and challenges in investigating early life origins of health and disease 3. and the SAPALDIA Youth Study designed to study early life factors of atherosclerosis. Results: Atherosclerosis is a multi-factorial disease with origins in childhood and in utero. Metabolic and morphologic alterations may result from ETS with toxic compounds crossing the placenta barrier and vaso-constrictive agents reducing the blood flow to the fetus. Childhood ETS exposure has been associated with cardiovascular risk factors: obesity,metabolic syndrome,leptin, adinopectin, CRP, oxidative stress. Studies on ETS and functional or structural changes of the vasculature in children are few. The challenge in research on early life origins of disease lies in the disparity of timing of exposure and disease manifestation. Developmental plasticity and adaptive responses of the human organism add to the complexity. The SAPALDIA Youth Study, the first Swiss offspring study, is designed to study early life factors and cardiovascular health, with a focus on atherosclerosis, addressing vulnerable time windows. Conclusion: ETS exposure in childhood is a risk factor for atherogenesis in adults and children. Considerable evidence supports the early life impact of ETS exposure on children's cardiovascular risk profile. First findings pointing to functional and structural changes to the vasculature in children need affirmation. The SAPALDIA Youth Study can bridge the time windows of early exposure and later disease manifestation.

Abstract Number	**P-3-11-10**
Presenter	Dmitri Dimitriev*, Elena Saperova, Aleksey Dimitriev
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	cross-sectional study

Effect of cigarette smoking on heart rate variability

Aims: The purpose of the present study was to investigate cardiac autonomic function in smokers and nonsmoker controls by analysis of heart rate variability (HRV). Methods: The sample consisted of 42 smokers and 42 nonsmoker subjects. Subjects were studied in the morning hours under standardized conditions, in a quiet room at a comfortable temperature. Time domain (SDNN, RMSSD, pNN50) and frequency domain (HF, LF and LF/HF ratio) parameters of HRV were obtained from all participants for 10 minutes while subjects were resting in a supine position. Statistical analysis was performed using Mann-Whitney test. Results: In this study heart rate was found to be higher in smokers than in nonsmokers (74.08±1.26 vs 64.28±1.15 ms, $p<0.00001$). Time domain parameters were found to be lower in smokers than in nonsmokers (SDNN: 52.07±3.17 vs 72.00±4.99, $p<0.0005$; RMSSD: 47.43±4.12 vs 69.94±7.14 ms, $p=0.006$ and pNN50: 25.76±2.28 vs 40.65±3.63, $p=0.003$). Frequency domain measures were also significantly lower in smokers than non-smokers (TP: 3401.76±471.68 vs 6154.42±924.17, $p<0.005$; VLF: 766.66±75.85 vs 1865.27±253.32, $p<0.00008$; LF: 1085.18±235.92 vs 1758.71±329.05, $p=0.011$ and HF: 1168.24±228.26 vs 2142.11±449.94, $p=0.015$). The other HRV parameters including LF/HF ratio, pLF and pHF were not significantly different. Conclusions: These results suggest that smoking has been associated with increased activity of the sympathetic nervous system and decrease in vagal cardiac control. This work was supported by the Ministry of Education and Science of the Russian Federation (grant 4.4904.2011, grant 14.B37.21.0215).

Abstract Number	**P-3-11-11**
Presenter	Asmi Panigrahi*, Bijaya Kumar Padhi
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Effects of household and outdoor air pollution on respiratory health in non-smoking, non-occupationally exposed women in rural Odisha, India.

Background: It is estimated that up to half of the world's population uses biomass fuel (wood, crop residues, animal dung and coal) for household energy purposes such as cooking, lighting and heating. Emissions from these sources lead to personal exposures to complex mixtures of air pollutants. As a result, a large proportion of women and children are exposed to high levels of air pollution. The short and long term effects of these exposures on the respiratory health of this population are not clearly understood. Aim: To conduct a surveillance of current practice and to examine the association between household use of biomass fuels and respiratory health outcomes among primary cooks. Methods: A population-based study in two villages more than 5 km away from the highway and a cross sectional survey in two villages within 100 meters of a major highway was conducted in the coastal district of Khorda in Odisha state. Nonsmoking and non-occupationally exposed women 18 year of age or older (n=405) completed a questionnaire on respiratory symptoms and illnesses and on use of cooking fuel. Results: Only 12% of households used liquid petroleum gas (LPG), while 35% used mixed fuel. At the time of the survey, 97%, 93% and 87% women used some form of biomass fuel, mosquito repellant, and incense sticks respectively. In this population, 37%, 24%, 22%, and 15% had cough, wheezing, shortness of breath, and physician diagnosed asthma respectively. In contrast to previous reports, proximity to a major highway appeared to have minimal impact, while use of mosquito repellant and biomass fuel showed a strong association with respiratory symptoms in a multiple regression analysis. Conclusions: Household use of high pollution cooking fuels may cause respiratory illness. Additional studies on a larger number of LPG users are underway to discern the effect of different exposures on respiratory health in similar settings. This study was funded in part by the Bhagabat Behera Memorial Student Ambassador Award to Asmi Panigrahi at the Asian Institute of Public Health, Bhubaneswar.

Abstract Number	**P-3-11-12**
Presenter	Ludmila Sevcikova*, Lubica Argalasova-Sobotova, Jana Babjakova, Jana Jurkovicova, Zuzana Stefanikova, Erika Machacova, Katarina Hirosova, Michael Weitzman
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	cross-sectional study

ETS IN HOUSEHOLDS – THE RISK FACTOR FOR PHYSICAL AND MENTAL HEALTH OF CHILDREN

. Background SHS exposure has been shown as an important environmental risk factor for health of predominantly vulnerable population groups - children of all ages. There are 19 % of Slovak school children exposed to passive smoking in a family with the significantly higher prevalence of respiratory diseases. Aims The aim of the project is to analyze the relationships among the SHS exposure and behaviour and health in 6-15 year old children in Slovakia. Methods The standard methods (anonymous questionnaires filled in by parents, CIS, BPI scales) were used for evaluation of the regimen habits, first experiments with smoking, environmental conditions, health status, emotional and behavioral functions in relation to second hand smoke exposure in the representative sample of 1,079 Slovak boys and girls of school age (6-15 year olds). SAS program was used for statistical analysis. Results The significant relationship was revealed between exposure to passive smoking at home and less sport activities of children ($p<0.05$), as well as positive significant correlations with longer daily TV watching ($p<0.01$). Smoking of parents or the other adult member of the family significantly influences children`s smoking. There were 4.6 % boys and 2.5 % girls in our sample with smoking experiences. These children were exposed to passive smoking in the family (boys – 94%, girls 88%). The relationships between exposure to secondhand smoke and the disorders of emotional (CIS scores >16) and behavioural functions (BPI score >14) were not significant, but we found significantly more negative emotional as well as behavioural characteristics (anti-social behaviour, anxiety and hyperactivity) in children having experiences with smoking. ConclusionsOur study indicates that the exposure of children to passive smoking is the serious environmental risk factor, which also indirectly negatively affects behavior and physical and mental health of children.

Abstract Number	**P-3-11-13**
Presenter	Håberg Siri, Roy Nilsen, Stein Emil Vollset, Øivind Midttun, Per Ueland, Michael Wu, Wenche Nystad, Shyamal Peddada, Stephanie J. London*
Exposure	others
Health domains	reproductive outcomes
Type of research	others

Evaluation of past smoking of mothers and DNA methylation in cord blood of infants

Background: Maternal smoking is related to multiple adverse health outcomes in children. We previously reported an association between maternal smoking during pregnancy and differential DNA methylation in newborn cord bloods for CpG sites (CpGs) in genes involved in the aryl hydrocarbon receptor signaling pathway and key developmental processes. However, it remains unclear whether these modifications to the infant epigenome reflect in utero exposures only or the inheritance of epigenetic marks from the mother. Aims: We evaluated the association between maternal smoking before or during pregnancy and DNA methylation for 21 CpGs previously identified as differentially methylated in response to maternal smoking in 1,047 newborn cord bloods from the Norwegian Mother and Child Cohort Study (MoBa). Methods: Maternal self-report of smoking as well as maternal plasma cotinine measured during pregnancy were used to distinguish mothers into four groups (never smokers, former smokers, smokers who smoked during pregnancy but quit by 18 weeks, and active smokers throughout pregnancy). The association between smoking and methylation was assessed using linear regression. Results: Having a mother who formerly smoked was not associated with differential methylation in cord blood for any of the 21 CpGs (at FDR of 0.05). Quitting during pregnancy was also not significantly associated with differential methylation (at FDR of 0.05) although methylation differences were larger than those for former smokers compared to never smokers. Only active smoking throughout pregnancy was statistically significantly associated with differential methylation (at FDR of 0.05). Conclusions: Differential methylation in newborn cord blood at the 21 CpGs that we previously found to be related to maternal smoking in pregnancy was only observed where mothers smoked during pregnancy. These findings suggest that DNA methylation at these locations in the infant epigenome reflects in utero exposure rather than epigenetic inheritance of smoking-related modifications in the mother.

Abstract Number	**P-3-11-14**
Presenter	Satoshi Nakai*, Keiichi Arashidani, Yukio Akiyama, Yoshikazu Ishizu, Takashi Amagai, Hideaki Matsuki, Miyuki Noguchi, Yukio Yanagisawa
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Evaluation of Personal Exposure to Environmental Tobacco Smoke in Daily Life -Twenty-four hour measurement and estimation of cigarette equivalent-

Background For smokers and non-smokers are engaged in social life comfortably together, it is important to minimize the passive smoking of non-smokers. The entire purpose of our study is to identify some indicators of passive smoking exposure that can be agreed socially and scientifically, and to quantify the degree of passive smoking. Aims In this paper, we report the personal exposure measurementto explore the actual condition of ETS exposure in current days in Japan and the calculation of CE (cigarette equivalent) to evaluate how much amount of passive smoking should correspond to the amount of active smoking. Methods　Subjects were university students, et al. SPM (suspended particulate matter), carbonyl, nicotine and3-EP （3-ethenylpyridine） were measured by using personal samplers for 24-hours. They were also asked to record the number of active and passive smoking and time activity pattern. Results Mean personal exposure levels of SPM, nicotine and 3-EP were the highest among active-smokers even not so high, and the lowest among non-smokers. Mean SPM concentration were 41.1 μg/m3 among active-smokers, 30.1μg/m3 among passive-smokersand 12.5μg/m3 among non-smokers. It was not observed clear relationship between measured exposure levels and the number of passive smoking and other tobacco related factors. It should be difficult to assess ETS exposure levels quantitatively by questionnaire. ROC(receiver operating curve) analysis showed that non-smokers and passive smokers could be classified based on nicotine exposure. CE exposures estimated based on nicotine were shown 0.25-10.5cigarettes per year. Conclusion It will be necessary to develop more sensitive passive samplers, and lightweight and quiet active samplers for ETS exposure assessment. Also, it should be required to consider how to evaluate health effects due to low ETS exposure. This work was supported in part by a grant from the Smoking Research Foundation.

Abstract Number	**P-3-11-15**
Presenter	Shah Khan, Syed Shah*
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Exposure to Environmental Smoke among Women in Rural Mountain Villages of Pakistan

Exposure to Environmental Smoke among Women in Rural Mountain Villages of Pakistan Khan, Shah Raees1; Shah, Syed M.2 1 Natural Resources Institute, University of Manitoba, 70 Dysart Road, Winnipeg, Manitoba, Canada 2Community Medicine, Faculty of Medicine & Health Sciences, United Arab Emirates University, Al Ain, syeds@uaeu.ac.ae Background: Smoking within the house results in exposure to high levels of indoor air pollution, with consequent health effects.Very little data is available about the burden of secondhand or environmental smoking in rural Pakistan. This study was conducted to assess the trends in tobacco use among women in a high mountain population of Pakistan during 1995-2011 and also to determine the burden of passive smoking among women. Methods: Two independent cross-sectional population surveys were conducted in 1995 and 2011 with stratified random samples of women aged 18-64 years from 16 villages in Ghizar, Northern Areas of Pakistan. The total number of participants with self-reported use of tobacco was 4,408. Results: Overall, during 1995-2007, the self-reported current cigarette smoking prevalence decreased from 2.7% to 1.4% and the prevalence of snuff (oral dip) decreased from 13.8% to 7.1%. However a substantial number of women (29.9%) were exposed to environmental smoke at home and at work. Half of the participants (49.2%) were exposed due to cigarette smoking by their husband, followed by relatives (30.6%), in-laws or parents (10.5%), their own children (6.2%) and, co-workers (3.5%). Conclusion: Passive smoking is substantial public health burden in women. Health care programs need to devise home-based prevention strategies involving household members. Increasing the awareness of the health-effects of indoor smoke may be the first step in implementing a programme to reduce exposure.

Abstract Number	**P-3-11-16**
Presenter	Laila Bano*, Syed Shah
Exposure	others
Health domains	healthrelated quality of life
Type of research	health impact assessment

exposure to environmental smoke and cigarette smoking among youth

Exposure to environmental smoke and cigarette smoking among youth: a double whammy 1Laila Bano , 2Syed M Shah Department of Earth and Environmental Science, Punjab University, Lahore Pakistan University, Al Ain, UAE Objective: Few data is available to environmental exposure to tobacco (secondhand smoking) and its sourcesamong youth in United Arab Emirates. We conducted this study to estimate the prevalence of secondhand smoking and cigarette smoking in youth aged 12 to 19 years. Methods: We selected a random sample of 1585 youth 9 schools in Al Ain. Information on tobacco use was determined from self-administered questionnaire. Height and weight were measured and body mass index (BMI) was calculated as kg/m2 and BMI >=85thand <95th percentile were used to define overweight and obesity according to the 2000 Centers for Disease Control and Prevention growth charts. Results:Among the participants 905 reported exposure to secondhand smoke. A high proportion of girls (54%) reported exposure to secondhand smoke compared to boys (33%) and this difference was significant statistically ($p<0.05$). The source of exposure to secondhand smoke included friends (66%), family members (17%) and public places (17%).Out of the total participants 1586, a majority (1576) responded to the question about cigarette smoking. Of those respondents 290 (18.3%) reported use of cigarettes. Six percent were current smokers while 12% smoked cigarettes in the past. There was no significant difference in use of cigarettes between local Emirati students (18.2%) and non-locals (18.5%). A high proportion (31%) of boys reported use of cigarette compared to girls (4%). The prevalence of smoking was 15% among youth who were overweight and 23% in obese. Conclusion: Cigarette smoking particularly exposure to secondhand tobacco is major health hazard in youth.

Abstract Number	**P-3-11-17**
Presenter	Samar Rabah*, Sahar El Hadad
Exposure	persistent organic pollutants
Health domains	respiratory disease
Type of research	exposure modeling

Histological changes of Mice lungs after daily exposure to different concentration of Incense smoke

Abstract:Since the discovery of Agarwood (Incense tree), many studies reported its characteristic effects and variable benefits, as either to produce Arabian Incense or as a traditional medicine against many diseases. Laboratory experiments were carried out on the effect of different concentrations of Incense smoke inhalation on the lung weight and tissue in female mice. This researchderives its importance from the fact that Incense is heavily used in Saudi Arabia in the absence of thorough studies of its effects on health. Eighty animals areusedin this study, and aredivided into four groups, eachis 20 animals. Three groups areexposed to different concentrations (2, 4 and 6 gm) of Incense smoke daily forthree months, and the fourth group is thecontrol. At the end of each month, five animals from each group were dissected. Obtained data showed an increase but not significant in animal body and lung weight, this results return to natural increase as a result of normal growth of animals. Light microscope reveals some changes in the lung tissue, such as focal emphysema, rupture in the alveolar walls, hemorrhage, congestion, edema and few peri-bronchial lymphoid cells. After continuous exposure to Incense smoke focal necrosis and degradation are observed in some cells of epithelial bronchioles. Also, fibrosis of peri-bronchial, thickening in alveolar walls and aggregation of lymphoid cells are demonstrated in some lungs sections . Conclusion: according to the above manifestations it could be concluded that exposure to Incense smoke causes pulmonary harmful effects. Therefore, we can recommend that Incense smoke will be used only in open places to reduce its harms

Abstract Number	**P-3-11-18**
Presenter	Mustafa Babayigit*, Olorunfemi Adetona, Luke P Naeher
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

HOW PEOPLE ARE EXPOSED TO SECONDHAND SMOKING IN OUTDOOR SMOKING AREAS OF BARS AND SIDEWALKS IN ATHENS, GEORGIA

Background:Exposures to secondhand smoking (SHS) may cause significant adverse health effects. And there are only a few data on actual levels of tobacco smoke exposure in outdoor environments. Aims: This study was conducted to measure particles ≤2.5 µm in aerodynamic diameter (PM2.5) in outdoor smoking areas of bars and sidewalks in downtown Athens, Georgia. Methods: A real-time SidePak AM510® Personal Air Monitor (TSI Inc., ST.Paul, MN) was used to monitor PM2.5 levels in outdoor smoking areas at six bars, indoor areas of three bars and three sidewalks, which had at least three bars, on two autumn weekend nights in Athens. Ten background locations were measured as control. Morover, present or passing smokers and number of cigarettes lit were counted for each sampling location. Results:PM2.5 levels were significantly higher in outdoor smoking areas of bars and sidewalks than levels at the background, and significantly and positively associated with the number of lit cigarettes (all p-values < .001). Only indoor levels of bar sites did not differ significantly from the control. Natural log-transformed PM2.5 (mg/m3) levels based on 30 s average raw data was 0.19±0.23 for outdoor smoking areas of the bars, 0.13±0.13 for the sidewalks, 0.09±0.04 for the indoor areas of the bars, and 0.03±0.03 for the backgrounds. There was a strong relationship between PM2.5 (mg/m3) concentrations and number of cigarette lit for the smoking locations (r2=0.73, p=0.005). The average level of PM2.5 with 50 lit cigarettes was 4.8 times greater than the average background level. Conclusions: The results of this study indicate that SHS leads to significant increases in PM2.5 outside smoking areas of bars and sidewalks, which had at least three bars, at the summer weekend nights.

Abstract Number	**P-3-11-19**
Presenter	Giovanni Battista Modonutti, Maria Fiore, Elena Sentina, Fulvio Costantinides, Luca Leon, Roberto Fallico, Margherita Ferrante*
Exposure	others
Health domains	other
Type of research	cross-sectional study

Medical students' knowledge concerning the tobacco use effects and related legislation

Background Smoking is associated with significant morbidity and mortality, therefore prevention of smoking-related disease is a major challenge for medicine. Aims This study examined medical students' knowledge concerning the tobacco use effects and related legislation in the fifth year of training. Methods A survey was carried out in the University of Catania, Italy.Students, recruited during lectures in the fifth year, were invited to complete a questionnaire assessing smoking status and self-reported knowledge concerning the tobacco use effects and related legislation. Results A total of 170 students (48.8% males and 51.2% females) participated in the survey, aged between 22 and 30 years (mean 23.7 years). Smokers (> 1.0 cig/day) was 20.6%. Approximately 30.0% (M:34.9 %; F: 25.3%) of students knew the legislation on tobacco use and 34.7% (M: 36.1%; F: 33.3%) of students believe that it is possible to smoke without having an impact on health.In particular, females think it is possible to smoke 2.3 cig/day without affect health while males think smoking less than one cigarette a day can have an impact on health. Despite this, 49.1% of students (M: 69.0% F: 25.0%) reported consumption of cigarettes higher than those they consider as a health risk. Conclusions Reduction of smoking habits is a goal for preventive medicine and the clinicians have an important role in advising patients on and aiding cessation so medical students must improve their knowledge about tobacco control strategies and smoking cessation interventions. These need to include education about tobacco in the medical curricula.

Abstract Number	**P-3-11-20**
Presenter	Hsing-Wei Lee*, Feng-Ming Tsao, Wu-Shiun Hsieh, Pau-Chung Chen
Exposure	neurotoxin
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to environmental tobacco smoke and language development in toddlers

Background: Maternal exposure to environmental tobacco smoke (ETS) associated with children's neurobehavioral development has been reported. There is also a study indicating that maternal smoking during pregnancy can affect newborns' speech processing ability. Language is a result of cognitive development; however, there is no study focus on the effects of maternal ETS exposure during pregnancy to toddlers' language and communication development. Aims: The aim of this study is to examine the effect of prenatal exposure to ETS on the language development in toddlers. Methods: A total of 103 children from the Taiwan Birth Panel Study (TBPS) were followed up in northern Taiwan. We enrolled their mothers before delivery, interviewed them using a structured questionnaire, and collected umbilical cord blood. Umbilical cord cotinine, a blood indicator of prenatal ETS exposure, was analyzed by using HPLC-MS/MS. The Mandarin-Chinese Communicative Developmental Inventory (MCDI) for toddlers was used to assess these children's language and communication development at 2 years of age. We examined the children's language development between exposed and control groups by multiple linear and logistic regression models to control for potential confounders. Results: Maternal ETS exposure during pregnancy was negatively associated with language and communication development. The adverse effects to the exposed group was significantly showed on the total MCDI score (β=-71.04; p=0.0396), word produced part (β=-65.81; p=0.0433) and syntax complexity part (β=-4.91; p=0.146) in multiple linear regression models. Conclusions: Our results indicate that maternal ETS exposure was related to the adverse effects on early children's language development. Further studies are needed to clarify the causal relationship between cord blood cotinine and children's language development.

Abstract Number	**P-3-11-21**
Presenter	Carrie V. Breton*, Xinhui Wang, Kim Siegmund, Frank Gilliland
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Prenatal Smoke Exposure, Tyrosine Receptor Kinase Methylation, and Childhood Respiratory Health

Background: Prenatal tobacco smoke exposure (PTS) may increase risk for poor childhood respiratory outcomes through induced epigenetic changes in immune response genes. The receptor tyrosine kinase AXL and its closely related family members, TYRO3 and MER (aka TAM), play a crucial role in inhibition of inflammation by preventing unrestrained signaling by Toll-like receptors and were recently described as the ultimate and previously unrecognized missing link in the tri-partite cycle of inflammation. Aims: We hypothesized that PTS affects TAM gene DNA methylation in a manner that alters key innate immune pathways involved in asthma and normal lung development. Methods: We investigated the association between CpG methylation in TAM genes using the Illumina HumanMethylation450 array in newborn blood spots and lung function level and prevalence of asthma assessed at age 11 in 252 children from the Children's Health Study. We related respiratory-associated CpG loci with PTS in a subset of 85. Linear and logistic regression models were used to evaluate FEV1, FVC and asthma. Beta regression models were used to evaluate PTS and CpG methylation. All analyses were conducted in the R software package. Results: 8 TAM CpG targets were associated with FEV1, FVC and an additional 5 with asthma, using a threshold p ≤0.1. Of these, 2 were also associated with PTS. A 1 % increase in CpG methylation in cg17354880 (MERTK) and in cg19270050 (AXL) was associated with decreased childhood FEV1 (β = -6 ml, p=0.07 and β = -49 ml, p=0.1) and FVC (β = -8 ml, p=0.05 and β = -55 ml, p=0.12) and with PTS exposure (β = 0.9%, p=0.08 and β = 0.3%, p=0.02). Conclusions: These associations are consistent with the hypothesis that PTS-related increased methylation may silence TAM genes, potentially leading to overstimulation of the immune system and negative effects on childhood respiratory health.

Abstract Number	**P-3-11-22**
Presenter	Linda Hägerhed Engman, Malin Larsson*, Thorbjörn Gustavsson, Laura von Kobyletzki, Yuexia Sun, Carl-Gustaf Bornehag
Exposure	no exposure
Health domains	allergies
Type of research	cross-sectional study

Reporting bias of smoking habits and home dampness – a result of study design?

There is a general trend of decreasing response rate when using questionnaires in epidemiological studies, and different actions to stop this are being discussed. Possible ways to increase it, as well as the validity, are to make the survey anonymous or change the way of distribution, e.g. via post, working site, school or day care centre. These different methodologies could affect the results. In the present study, two different questionnaire studies were analysed (2000, 2006), with the same age-population (1-6y), from the same city and using the same questions, but with different way for distribution and personal identification. The two questionnaires contained questions about the home environment of the children, asthmatic and allergic problems in the family. The study 2000 was focus on dampness, home environment and health and the questionnaire 2006 on day care centre. The two study populations showed equally distribution in sex and age, asthmatic/allergic symptoms, time spent at day care centre and age of enrolment. Reported dampness in the homes was similar in both populations. Parental reports of smoking were 23% in the first study and 18% in the study six years later. Parental reports of mouldy odour in the home and window pane condensation were significantly associated with eczema and asthma in the first study in 2000, but not in the study 2006. In opposition, parental smoking was not associated with asthma and rhinitis in the study from 2000, but in the anonymous study in 2006. This study indicates that associations between health with parental smoking and with dampness and might be due to if the questionnaire is anonymous or not, and/or the focus of the questionnaire since there is a general knowledge that smoking and dampness are a risk factors for asthma/allergy i.e. a reporting bias i.e. people might be ashamed to report this if their child has asthma.

Abstract Number	**P-3-11-23**
Presenter	Chi-Hyeon Lee*, Byeong-Kyu Lee
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

Risk assessment and exposure level analysis to indoor air pollutants of the residents in the smoking and non-smoking PC rooms

Many people enjoy computer games in the personal computer (PC) rooms which currently are separated as smoking and non-smoking areas. The residents in the PC rooms, particularly smoking areas, could be highly exposed to various indoor air pollutants (IAPs) containing particulate matter (PM), volatile organic compounds (VOCs), aldehydes and environmental tobacco smoke emissions. This study analyzed exposure level to those IAPs of the residents in the smoking and non-smoking areas of the PC rooms and tried to assess risk of the IAPs exposure. Personal air samples for PM, aldehydes and VOCs were collected in the smoking and non-smoking areas of the PC rooms during summer and fall seasons. The carcinogenic and non-carcinogenic risks were assessed according to the risk assessment methods suggested by the US EPA. The average concentrations of PM10, PM2.5, formaldehyde, acetaldehyde, benzene and toluene in the smoking area were 1.3, 2.8, 1.7, 1.5, 1.8 and 1.7 times significantly (PM10: $p<0.05$, PM2.5, formaldehyde, acetaldehyde, benzene, toluene: $p<0.01$) higher than those in the non-smoking area. The carcinogenic and non-carcinogenic risks of the PC room users in the smoking area were 1.52 X 10-4 and 8.61 X 10-3 and the risks in the non-smoking area were 7.40 X 10-5 and 7.45 X 10-3, respectively. The carcinogenic risks of the PC room users in the smoking and non-smoking area were exceeded the acceptable risk standard (10-5~10-6), however, the non-carcinogenic risks were lower than the acceptable value (<1).

Abstract Number	**P-3-11-24**
Presenter	Khaled Awawdi*, Manfred Green, Yonathan Hasin, Shira Zelber-Sagi
Exposure	household air pollution
Health domains	cardiovascular disease
Type of research	case-control study

The Association between Passive Smoking and Acute Coronary Heart Diseases among Arab Israeli Women in Northern Israel

Background: Cardiovascular diseases are the leading cause of death western countries. The deleterious effect of exposure to passive smoking on many pathophysiological intermediaries of coronary heart disease (CHD) is as great as the effect of active smoking. Exposure of passive smoking has not been studied as an independent risk factor for CHD among Arab women. The study objectives were to examine the association between the exposure and different levels of exposure to passive smoking to CHD among Israeli Arab Women in the Northern Israel and, in addition, to examine the attitudes of Israeli Arab women toward passive smoking. Method: non-smoking Israeli Arab women were interviewed, using a general questionnaire and, passive smoking questionnaire. Anthropometric measurements (Weight, BMI, and Waist/Hip ratio), blood pressure (HTN) and pulse were obtained during the interview. Results: A total of 146 women (73 cases, 73 controls) whom agreed to be interviewed (90.12% response rate). After adjustment for HTN, BMI>25 and Family history of CHD, the independent risk factors were: exposure to passive smoking during last five years of marriage (odds ratio (OR) 6.1; 95% confidence interval (CI) 1.93-19 .3), exposure to passive smoking during 2-6 hours level a day (OR 5.67; 95% CI 1.48-21.73), exposure to passive smoking more than six hours a day (OR=26.11; 95% CI 4.26-159.91). In examining Arab women attitudes to smoking at home, in public places and at family events, women from the cases group significantly tended to agree more with the prevention and prohibition of smoking in these places. However, in assessing the ability to limit the smoking in their environment women from the cases group showed a weaker position than women from the control group. Conclusion: Among Arab Israeli women, passive smoking is a significant risk factor independently associated with coronary heart disease and with a positive dose-response relationship.

Abstract Number	**P-3-11-25**
Presenter	Chi-Jung Chung*, Chao-Hsiang Chang, Chiu-Shong Liu, Yi-Huei Chang, Mu-Chi Chung
Exposure	gene-environment interactions
Health domains	cancer
Type of research	case-control study

The effect of cigarette smoking and DNA methyltransferase genes polymorphisms on urothelial carcinoma risk in Taiwan

Background: Previous studies suggested that DNA methyltransferase (DNMT) gene polymorphisms are involved in breast, lung, and colon carcinogenesis. However, only a few studies showed the interaction of DNMT genotypes and cigarette smoking on urothelial carcinoma (UC) risk. Aims: We constructed a hospital-based case-control study to elucidate the role of global DNA methylation in UC carcinogenesis. Methods:Total 192 and 376 matched cases and controls were respectively recruited at the Department of Urology and Family Medicine, China Medical University Hospital in Taiwan. All subjects had completed questionnaire information and collected blood samples for the identification of enzyme gene polymorphisms. Genotyping of DNMT1 exon 4 His97Arg, DNMT1 exon 19 Pro463Pro, and DNMT3B −579G>T was performed by a polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) method. Multivariate logistic regression models were used to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) to determine the interactions of gene polymorphisms and cigarette smoking on the risk of UC after adjustment for other risk factors. Results: The results indicated that the ORs for UC were about 2-fold risk in subjects who were former smokers and current smokers compared with those who were non-smokers. However, the gene polymorphisms of DNMT1 exon 4 His97Arg, DNMT1 exon 19 Pro463Pro, and DNMT3B −579G>T 5-MeC did not show any associationon UC risk. Conclusions: There is not the significant interaction of DNMT gene polymorphisms and cigarette smoking on urothelial carcinoma (UC) risk.

Abstract Number	**P-3-11-26**
Presenter	Ruey-Yu Chen*, Wen-Ling Chen, Ching-Ying Yeh, Pi-Hui Lee, Chuang-Mei Hsu, Chiu-Mei Wang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

The Effectiveness of Smokefree Park Program in Da-An District, Taipei

Background: The promotion of smoke-free public place is an essential part of community tobacco control. The smoke-free parks have been established since 2007 in Taipei. This study aimed at evaluating the effectiveness of tobacco control in four smoke-free parks in Da-An District, Taipei. Results: A total of 520 participants including residents, students in neighborhood schools, and employees of neighborhood workplaces, completed a questionnaire. The surrounding populace expressed high agreement on smoke-free parks with 82% of supportive rate and 66% of satisfactory rate, which was higher than that was reported three years ago. The supportive rate and the satisfactory rate among male smokers (58% and 52%, respectively) were much lower than the average, which revealed the importance of strengthening health education for this specific group. The advocacy of smoke-free parks was most effective via notification from borough chief and no-smoking signs in the parks. The smoking rate was low in the study district (18% and 5% among male and female, respectively); however, the environmental tobacco smoke (ETS) in other public places such as sidewalks and arcades was considerable. Conclusions: The opinions from most of the participants showed that the promotion of smoke-free parks is necessary. We suggest the government to advocate smoke-free public places via mass media. The local health organization may cooperate with surrounding communities, schools and workplaces to prevent ETS. The volunteers for the smoke-free park promotion should be encouraged and praised. The monitoring of outdoor ETS and smoking rate should be carried out regularly to sustain the good performance of smoke-free parks.

Abstract Number	**P-3-11-27**
Presenter	Giovanni Invernizzi, Ario Alberto Ruprecht*, Roberto Boffi, Cinzia De Marco, Roberto Mazza, Maria Jose Lopez, Constantinos Sioutas, Dane Westerdahl, Grisa Mocnik, Esteve Fernandez
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

The Influence of Secondhand Smoke (SHS) on Outdoor Air Quality in Leisure and Sport Facilities: Measurements at a Stadium, Car-Free Recreation Zone, City Park,

BACKGROUND: Outdoor SHS is not regarded as health risk, however outdoor SHS exposure is often encountered in leisure and sport activities areas. AIMS: to evaluate outdoor exposure to SHS. METHOD: Measurements of PM2.5 with OPC Aerocet 531 and BC (Black Carbon) with Aethalometers AE51, nicotine vapour phase with active samplers and GC. Procedures: a) Stadium: Sets of analyzers and nicotine samplers inside and outside the facility. Airborn nicotine sampled before, during and after game end. b) Car free recreation zone: measurements from Friday until Monday in pedestrian area and in parallel trafficked zones. c) City Parks: analyzers on park benches downwind from smokers. d) Public Beach: BC analyzers upwind and downwind beach umbrellas. In all places cigarette consumption estimated. RESULTS: Stadium: BC, PM2.5 and airborn nicotinemeans outside stadium: 2.1, 6.2, and 0.12 µg/m3 respectively, inside during game: 3.1, 13.9, 3.16 µg/m3, increasing factor of 1.5, 2.2, 25.9 for BC, PM2.5 and nicotine respectively ($p < 0.005$). Car free recreation zone: BC and PM2.5 mean concentrations during quiet hours in pedestrian zone: 2.8, and 35.4, while they increased to 4.1 and 64.9 µg/m3 respectivelyduring rush hours ($p=0.0001$). In trafficked zone during quiet hours: 3.7, 30.4 and 4.8, 31.8 µg/m3 during rush hours for BC and PM2.5 respectively. Nicotine: < 0.02 µg/m3 in trafficked zone and 0.26 µg/m3 in pedestrian zone. City parks: means background: 5.1, 16.6 µg/m3 while 12.6, 17.8 µg/m3 sitting near smokers for BC ($p= 0.000$) and PM2.5 ($p= 0.039$) respectively. Public beach: mean BC upwind: 878.00 ng/m3 and 1518 /m3 downwind ($p=0.000$), with peak of 6,049.00 ng/m3 at 5 meters from two smokers. CONCLUSION: Air quality in car-free areas during rush hours is worse than in parallel high-traffic street. Increase of more than 1 epidemiological change unit for BC and PM2.5 is observed due to SHS with concern for short- and long-term health consequences.

Abstract Number	**P-3-11-28**
Presenter	Gayle Windham*, Robert Voss, Mary Wolff, Susan M. Pinney, Susan Teitelbaum, Lawrence H Kushi, Frank M. Biro, Robert Hiatt, Louise Greenspan, Maida Galvez, Connie Sosnoff
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

URINARY COTININE LEVELS IN GIRLS AND TIME TO PUBERTY

Background: Exposure to hormonally active chemicals may affect the timing of puberty, which influences long-term health outcomes. Tobacco smoke contains thousands of chemicals, including known reproductive toxicants. A few studies have examined second-hand smoke (SHS) exposure in relation to age at menarche, but not to earlier markers of puberty. Aims: Examine cotinine levels in relation to reported SHS exposure and age at pubertal onset. Methods: Ethnically diverse cohorts of girls recruited at ages 6-8y have been followed for at least six years at 3 BCERP sites. Tanner stages (breast (B) and pubic hair (PH)), BMI, demographic variables, and smoke exposure were obtained from annual physical exams and questionnaires.Cotinine, the primary metabolite of nicotine, was measured by a sensitive assay in urine collected at baseline (n=1175), corrected for creatinine, and categorized into quartiles. Using accelerated failure time models that account for left, right, and interval censoring, we calculated time ratios (TRs) for cotinine and age at pubertal onset (age at maturation stages 2 or higher), adjusting for confounders. Results: Cotinine levels were similar to other U.S. samples, but varied by site and SES. Cotinine quartile was directly and significantly related to the number of smokers in the home. In unadjusted models, age at B2+ was younger with increasing cotinine level, with some evidence of dose-response. Adjustment for race/ethnicity, caregiver education, and household income reduced the associations, but girls in the highest quartile reached B2+ on average 3-4 months earlier than girls in the lowest quartile (TR 0.97, 95% CI 0.94-0.99). In adjusted models there was no association with age at PH2+. Conclusions: Cotinine was detected in all girls, even among those with no reported SHS exposure, at generally low levels. Our preliminary results suggest earlier age at breast development with higher concentrations of cotinine/SHS, a modifiable exposure.

Abstract Number	**P-3-12-01**
Presenter	Morteza Khafaie*, Behzad Khafaie, Chittaranjan S. Yajnik
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	cross-sectional study

Ambient temperature and biomarkers of cardiovascular events

Background: Climatic, especially changes in temperature are associated with cardiovascular (CV) events but underlying mechanisms are not well understood. We examined association between air temperature and CV biomarkers such hemoglobin (Hb), fasting plasma glucose (FPG), and C-reactive protein (CRP), in type 2 diabetes patients. Methods: The subjects were (943 men and 757 women) diabetes patient resident of Pune city and suburbs. The relationship between air temperature and biomarker concentration were analysed using robust regression models. Result: Mean daily air temperature during study period varied between 15°C to 34°C. A 5°C decrease in the air temperature was associated with significant increase in arithmetic mean of Hb concentration ranging from 1.59% to 3.74%, for lag period up to 5 days before blood collection and of 3.19% and 3.80% for average last 3 and 7 days respectively. Similarly, increase in geometric mean of FPG concentration was observed for the same lag time and multidays average (4.64% to 7.76% for lags days and 6.94% and 9.67% for multi- days) whereas, CRP showed an increase of 15.26% in geometric mean (95% CI = 4.42 to 24.88) with a lag of 1-day. Conclusion: This study suggests that decrease in temperature is associated with change in several CV risk biomarkers. We need to investigate physiological and environmental mediators of this association to help improve CV risk.

Abstract Number	**P-3-12-02**
Presenter	Chava Peretz*, Alina Rosenberg, Miriam Weinberger, Shlomit Paz, Larisa Lerner, Lea Valinsky, Israel Nissan, Verad Agmon
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Ambient temperature and notified Campylobacter in Israel; a time series analysis

Background: Campylobacter infection poses a serious public health problem worldwide. Since the incidence varies between seasons, it is expected to be influenced by global climate changes. Aim: We studied the relationship between ambient temperature and weekly notified Campylobacter infections, using time-series analysis. Methods: Data on 29762 laboratory-confirmed cases of Campylobacter for the period 1999-2010 in the Jewish population were obtained from the Campylobacter Reference Center.Mean temperature and relative humidity for each week were calculated based on the airport monitoring station records. We used piecewise (two-segment) linear Poisson regressions, to estimate the association between weekly cases ofCampylobacterand average temperature value of lags 0-9 weeks. The effect of temperature was adjusted for seasonality, linear long term trends, holiday's indicator and relative humidity. Results: We found a J-shape relationship between temperature and Campylobacter cases. For the whole population, the percent increase in cases for 10C, below and above a threshold of 250C, was 3.5%(95%CI:1-6%) and 12%(95%CI:7-17%), respectively. The thresholds and the exposure-response curves varied between 3 age groups: 0-2y (28% of cases), 2.1-10y (25%) and 10.1+y (47%). For young children (groups: 0-2y and 2.1-10y) the curve was positive below and constant above the threshold; for ages 0-2y the percent increase in cases for 10C below a threshold of 210C was 7.7%(95%CI:4-11%), and for ages 2.1-10y it was 7.2%(95%CI:2-12%) below a threshold of 190C. For ages 10+y, the exposure-response curve was constant below and positive above the threshold; the percent increase in cases for 10C above a threshold of 24.50C was 15%(95%CI:8-22%). Conclusion: Our findings indicate that higher temperatures throughout the year are important and further intervention and education on food-handling behavior is needed. The difference in the age-related curves should be further explored.

Abstract Number	**P-3-12-03**
Presenter	Waqar_ul_hassan Tareen*
Exposure	climate change (temperature)
Health domains	policy
Type of research	occupational study

An Exploratory Study of Social Safety Nets (SSN) in Battagram District of Khyber Pakhtunkhwa Province: Implications for Food Security of Small Farmers

An Exploratory Study of Social Safety Nets (SSN) in Battagram District of Khyber Pakhtunkhwa Province: Implications for Food Security of Small Farmers Agriculture is the major driver of growth of Pakistan’s economy. However the agriculture in the Khyber Pukhtunkhwa (KP) is primarily a small farm activity. Major part of KP is mountaineous having severe cold weather. The heavy snowfall makes farming very difficult. The small farmers of KP have limited resources to sustain their living. Moreover, in KP 12 out of 24 districts are severely threatened with food insecurity and access to food is said to have become a major problem for the entire province. Social safety nets (SSNs) are therefore introduced to assist people who have been adversely affected due to poverty. One of the two tehsils was chosen randomly through simple random method then from that tehsil 2 union councils were selected randomly. From each of the selected union councils (UCs) 3 villages were selected by using simple random sample technique. Later on, from each village 20 respondents were selected randomly thereby making a sample size of 120 respondents. Quantitative data was also collected with the help of well-structured interview schedule while qualitative data was collected by using open ended interview guide. The data was analyzed by using computer software Statistical Package for Social Sciences (SPSS). It was concluded that majority of farmers had less access to the government provided safety nets and were mainly dependent on the political relations. The access of small farmers to NGOs and semi government provided social safety nets was comparatively better but it was greatly influenced by social relations. The low level of awareness and poverty were found to be the major factors limiting the access of farmers to different social safety nets. There was meager interaction between different safety nets working in the study area. Social safety nets can play an effective role in food security if launched on regular basis and according to the needs of the local community

Abstract Number	**P-3-12-04**
Presenter	Hyung-Nam Myung*, Kyung Eun Lee, Wonwoong Na, Jae-Yeon Jang
Exposure	climate change (temperature)
Health domains	other
Type of research	others

Analysis of Factors Influencing the Mortality of Local Governments by Meteorological Disasters

Background Victims by meteorological disasters hold an important place among the influences of climate changes on health. It is required to analyze the factors influencing mortality by meteorological disasters in order to establish policies to prevent victims by meteorological disasters. Aims The purpose of present study was to analyze the factors influencing the mortality of cities, guns, and gus, the basic administrative unites, for meteorological disasters that took place in South Korea. Methods The study sorted out the number of deaths in 232 cities, guns, and gus for meteorological disasters from 1990 to 2008 based on the annual disaster reports issued by the National Emergency Management. The study also gathered data of local indexes for each year from the Meteorological Administration, National Statistical Office, and Ministry of Environment, and National Forestry Administration to identify the variables affecting the mortality. Multiple linear regression was performed for statistical analysis. Results As for meteorological factors, mortality increased with the increasing number of days with the wind velocity of 14m/s, number of disasters, and monthly mean precipitation($p < 0.001$). The average annual mortality per 1,000,000 increased by about three as the number of days with the maximum wind velocity of 14m/s increased by one. As for geographical factors, mortality increased with the increasing area of forests($p < 0.001$) and the increasing number of households located in low land of 10m or lower($p < 0.05$). As for socioeconomic factors, mortality decreased with the increasing financial independence of local governments($p < 0.05$) and the increasing distribution rate of water and sewer utilities($p < 0.001$). Conclusions The research findings show that the factors influencing the mortality of local governments by meteorological disasters include the wind velocity, precipitation, area of forests, number of household located in low land of 10m or lower, financial independence, and distribution rate of water and sewer utilities.

Abstract Number	**P-3-12-05**
Presenter	Sutyajeet Soneja*, Patrick Breysse, James Tielsch
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	exposure measurement

Assessment of Household Emissions due to Cookstoves in Southern Nepal

Background: Black carbon (BC) is a component of particulate matter (PM) made by the incomplete combustion of biomass burning. Having a short atmospheric residence time, BC deposition on glaciers causes a decrease in surface albedo, thus accelerating the melting process. Also, while in the air BC causes the surrounding atmosphere to warm abnormally, thus altering the natural hydrological cycle. Within the Himalayan region, large amounts of BC deposition impact glacier availability, which act as a water source for roughly a billion people throughout South & East Asia (SEA). A large majority of BC production in SEA is thought to come from cooking with biomass fuels (e.g. wood, animal dung, or crop waste). 80% of PM is estimated (based on calculations, no field data) to exit from household to the atmosphere in SEA. Aims: Our research seeks to develop field-based estimates of the amount of PM and BC that is ventilated from households due to the use of traditional cookstoves and other determinants in this region of the world. Methods: Testing has consisted of conducting controlled cooking sessions in a test house, with varying combinations of prevalent area fuel sources along with having the window/door being open/closed. Testing has also been performed in 50 homes. We determined the exfiltration fraction and the total amount of PM that is ventilated into the atmosphere from the house from the decay rate ratio of PM over carbon monoxide (CO). Results: Exfiltration fraction, the fraction of indoor PM generated during a cooking event that exfiltrates outdoors, ranged from 9.43% to 35.64%. This corresponds to emission of 3.16 µg BC/cooking event to 18.93 µg BC/cooking event. Data analysis is still ongoing. Research Direction: Our research will improve our understanding of the role that households play in contributing to atmospheric emissions of PM and BC in this region of the world. This is a key step in the process of developing better emission profiles for the Indo-Gangetic Plain so as to validate and potentially improve upon regional climate change models.

Abstract Number	**P-3-12-06**
Presenter	Atanu Sarkar*, Joel Finnis
Exposure	climate change (temperature)
Health domains	other
Type of research	others

Changing Climate in Rural Canada: Linking Scientific Evidence and Population Perspectives

Background: Adaptation is an important means of protecting communities from the adverse health impacts of climate change. However, disconnections between scientific evidence of climate change & population perspectives complicate the development of meaningful adaptation strategies. Interestingly, the majority of global studies address them in two different contexts. Aims: The study aims to analyze the pattern of climate change in some Canadian communities, explore their perspectives on climate change and establish links between two. Methods: A telephone survey was carried out in 2012 in 65 communities in Western Newfoundland. The participants were above 40 years old & residents of the area for at least 30 years. Survey results were subsequently compared to trend analyses of data collected from nearby climate stations, operated by Environment Canada. Results: Out of 97 participants, 96.9% reported noticeable changes in climate over the past 20-30 years. 95.5% and 97.7% respectively experienced warmer summers and winters. 80.3% reported longer summers, while 90.5% reported shorter winters. 97.7% noticed less snowfall. Analysis of collocated climate stations confirm that shifts consistent with projected anthropogenic warming have occurred in recent decades. However, the region's response to climate change has been delayed relative to the majority of Canada. Until recently, the study area was experiencing a decades-long cool period associated with natural climate variability, which effectively masked any anthropogenic influences. This cool period effectively ended in the late 1990s; it is likely that this rebound to 'normal' conditions, combined with gradual anthropogenic warming trends, has amplified the public's perception of climate change. Conclusions: Population perspective of climate change is consistent with scientific evidence at local level, indicating potential opportunity to develop socially acceptable adaptation strategies.

Abstract Number	**P-3-12-07**
Presenter	Beth Feingold*, Benjamin Zaitchik, Alex Sandoval, Carlos Alvarez Antonio, Rosa Patricia Zegarra Vasquez, William Kuang-Yao Pan
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Climate and land use drivers of the spatial and temporal distribution of malaria risk in the Peruvian Amazon

Background: Malaria remains one of the world's most devastating public health threats. In Peru, 75% of malaria occurs in the northern Amazon region of Loreto where 80% of cases are concentrated in just 10 districts. Loreto is the least densely populated region of Peru and also the largest. To maintain the declining malaria rates currently seen, better knowledge of where, when and why people are infected is needed. The primary factors affecting malaria endemicity in Loreto are vector habitat expansion from land use change, and social and ecological processes that increase human exposure. Coupled with this, changes related to climate, including rainfall and flooding, temperature, humidity and soil moisture are all also linked to the growth and survival of both the parasite (Plasmodium sp.) and the dominant mosquito vector in the Amazon,Anopheles darlingi. It remains unclear in this region where prevention efforts should be targeted based on the complex suite of factors involved. To refine and focus prevention strategies, spatially explicit risk estimates are necessary. Aims: In this study, we investigate how malaria risk varies across time and space in Loreto by modeling the relationship among climate, land use, and malaria from 2001 to 2012. Methods: Using a poison random effects model, we incorporate annual measures of land use, spatial ecology, and weekly climate variables with weekly epidemiological data reported from 356 government health posts in Loreto over twelve years. Results: Initial models indicate increased malaria risk for lagged rainfall and soil moisture as well as land areas prone to flood. Conclusions: These models will be compared against current forecasting methods to determine if more efficient prevention and control efforts can be implemented.

Abstract Number	**P-3-12-08**
Presenter	Jan Semenza*, Dragoslav Domanovic
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	health impact assessment

Climate change threats to the blood supply

Background Current microbial blood safety practice of the blood supply is based on calculated risks posed by known bloodborne pathogens (e.g. HIV or Hep B) with subsequent enforcement of protective measures, such as donor and donation screening to identify and defer potential high risk donors. The convergence of infectious disease drivers such as climate change and international air travel has created conditions amenable to the donor related transmission of emerging infectious diseases (EID) through blood transfusion. Aims We evaluated the risk to the blood supply from global environmental change in Europe with the aim to identify and prioritize EIDs threats. Methods Two official government assessments were conducted to prioritize EID according to risk for the blood supply from climate change. The first assessment ranked EIDs threats from climate change; the second from their impact to the safety of substances of human origin in the EU. These two rankings were merged and is listed below. Results The overall priority rank was: 1) West Nile Fever; 2) Dengue; 3) Leishmaniasis; 4) Chikungunya fever; 5) Malaria; 6) Tick-Borne Encephalitis; 7) Borreliosis; 8) Crimean-Congo hemorrhagic fever. The climate change threat from these EIDs was mapped out for each EU country and weighted against evidence from the literature. This ranking illustrates that traditional screening tests of the blood supply run up against cost-effectiveness and feasibility limits; moreover, new pathogens can easily evade detection until sensitive tests have been developed. Thus, contamination of the blood supply with EIDs is a serious patient safety concern. Conclusions This predicament calls for alternative strategies such as pathogen reduction technology. It can be applied to most known and unknown agents and in combination with donor and donation screening this strategy might ultimately be the way forward to assure the safety, adequacy, and affordability of the blood supply.

Abstract Number	**P-3-12-09**
Presenter	Kuo-Tsang Huang*, Reuy-Lung Hwang, Tzu-Ping Lin
Exposure	climate change (temperature)
Health domains	physical activity
Type of research	health impact assessment

Effect of Roof Reflectivity and Roof Greening on Improving Indoor Thermal Comfort of Classroom in Hot-and-Humid Climate

Background: Many antiquated rooftop classrooms are constructed with metal roofs and are usually equipped with poor insulation, which result in high indoor temperature and heat stress in summer especially when operated in natural ventilating mode in hot-and-humid Taiwan. This study proposed two inexpensive methods for retrofitting by changing the metal roof's surface color as well as thin-layered rooftop greenery to improve indoor thermal comfort condition. Efficiencies of alleviating indoor heat stress of the applications were discussed. Aims: In order to evaluate the effectiveness of the proposed measures on alleviating heat stress of rooftop space, this study quantified the general and local thermal discomfort severities of roof reflectivity and roof greening in long-term perspective via simulation technique. Methods: An actual top floor flat-roofed classroom located in northern Taiwan was modelled in dynamic simulation tool, EnergyPlus. Hourly simulated results of indoor operative temperature, surfaces' temperature were obtained by EnergyPlus with local typical meteorological year. For general thermal comfort assessment, ASHRAE adaptive thermal comfort model was adopted to evaluate indoor thermal comfort for naturally ventilated space. Long-term severities and occurrences of overheat as well as local thermal discomfort due to radiant asymmetry were evaluated using methods suggested in ISO 7730. Results: Capability of using high reflected roof coating and rooftop greenery in reducing both the severities and the occurrences of indoor thermal discomfort was confirmed. Simulated results exhibit that soil layered roof greening with 16 cm in depth, over 20% of overheat severity could be alleviated. For roof reflectivity, 10-15% improvement could be observed for the case with white coating in comparison with that of dark coating. Conclusions: Although rooftop greenery performs better in achieving thermal comfort, roof reflectivity remodeling is prior recommended for improving indoor thermal comfort of metal roofed spaces in life cycle cost perspective.

Abstract Number	**P-3-12-10**
Presenter	Tzu-Chieh Chou*, Wu Shu-Huan, Wu Fang-Yang, Sung Fung-Chang
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Effects of macro climate change on dengue fever incidence in Taiwan

BACKGROUND: Dengue fever is a vector-born disease raging at tropical and subtropical regions for hundred years of the history in Taiwan. Recently, many studies discussed macro climate changes and extremely weather events may play important roles to impact dengue fever occurrence. AIM: The aim of this study was to evaluate whether the dengue fever epidemic in Taiwan is associated with the unusual climate events such as El Niño and La Niña events. METHODS: In this study, the epidemiological data originated from weekly confirmed records at were obtained from the Taiwan Centers for Disease Control. The weather data on typhoon and other events were obtained from the Central Weather Bureau. Oceanic Niño Index (ONI) derived from National Oceanographic and Atmospheric Administration (NOAA) was used to describe El Niño and La Niña events. We obtained data from 1998 to 2010. Multiple regression model was used to evaluate the relationship between unusual climate factors and incidence of dengue fever. RESULTS: In 1998 to 2002, there were increased events of ONI, which was significantly associated with an increase in the monthly dengue fever incidence per 100,000 person years (B = 0.611; p<0.001). However, the reverse relationship was shown between ONI and dengue fever incidence from 2003 to 2010 (B= -0.182; p= 0.016). Dengue fever incidence was lower in 1998-2002 than in 2003-2010. The results showed lower incidence was positively associated with ONI, and higher incidence was negatively associated with ONI. CONCLUSION: Our results perhaps explain that dengue fever occurrence was affected by El Niño or La Niña period in Taiwan. Furthermore, the macro climate events such as El Niño or La Niña could be the predictor of dengue fever occurrence in Taiwan. The follow-up monitoring of these special climate events for the effects to vector-born diseases in Taiwan should be warranted.

Abstract Number	**P-3-12-11**
Presenter	Kathryn Conlon*, Evan Mallen, Nicholas Rajkovich, Larissa Larsen, Marie S. O'Neill
Exposure	climate change (temperature)
Health domains	other
Type of research	others

EMPLOYING HEAT VULNERABILITY MAPPING TO INFORM WEATHERIZATION PROGRAMS IN 3 US CITIES

Background Vulnerability mapping is a popular tool for investigating spatial relationships among community characteristics. Temperature exposure risks are unequally distributed, disproportionately burdening the elderly, minority and poor residents. As cities aim to reduce the burden of temperature-related morbidity and mortality, weatherization programs are poised as an option for implementing protective measures. Aims We expanded upon a methodology for heat vulnerability mapping (Reid, 2009) using fine-scale environmental, socio-economic, demographic, health and housing data. Methods Principal component analysis was conducted using 1 m resolution land cover classifications, ZIP code-level cardiovascular and respiratory disease prevalence, and census block group demographics that may contribute to vulnerability in three US cities: Detroit Michigan, Cleveland Ohio, and Washington D.C. Vulnerability scores were calculated and mapped for each city. Block groups comprising the 10% most vulnerable for each city are selected and presented to include parcel-specific housing characteristics. Results Factor scores include elderly/isolation, socio-economic/demographic vulnerability, and non-vegetated areas. 2010 census block groups (n=881) for Detroit were assigned heat vulnerability index values (6-17) and mapped with corresponding housing data. The most vulnerable areas of the city are located along the urban core where elderly populations are highest. Age and condition of housing stock are overlaid to elucidate areas of the city where housing characteristics may contribute to additional vulnerability to temperature. Results for Cleveland and Washington DC are mapped and presented. Conclusions Vulnerability mapping incorporating fine-scale data provides neighborhood-specific analyses for use in targeted decision-making for climate adaptation programs. Inclusion of housing stock data informs weatherization programs that target vulnerable groups. This research begins to address potential co-benefits of weatherization efforts as it relates to heat vulnerability.

Abstract Number	**P-3-12-12**
Presenter	Zhiwei Xu*, Wenbiao Hu, Hong Su, Lyle Turner, Jiajia Wang, Shilu Tong
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Extreme temperatures and pediatric emergency department admissions in Brisbane, Australia

Background: Previous studies have assessed the health impact of temperature on morbidity among elderly, but few data are available on the relationship between temperature and morbidity among children. Aims: To examine the relationship between extreme temperatures and pediatric emergency department admissions in Brisbane, Australia, during 2003–2009. Methods: A quasi-Poisson generalized linear model combined with a distributed lag non-linear model was used to examine the relationships between extreme temperatures and pediatric emergency department admissions. The model residuals were checked to identify whether there was an added effect due to heat waves or cold spells. Results:Both hot and cold temperatures were significantly associated with an increase in pediatric emergency department admissions in Brisbane. Hot temperatures had a significant impact on several pediatric diseases, including intestinal infectious diseases (relative risk (RR):1.26, 95% confidence interval (CI):1.10 – 1.45), endocrine, nutritional and metabolic diseases (RR:1.41, 95% CI:1.09 – 1.82), nervous system diseases (RR:1.40, 95% CI:1.09 – 1.78), digestive system diseases (RR:1.23, 95% CI:1.05 – 1.46), genitourinary system diseases (RR:1.27, 95% CI:1.05 – 1.55), and chronic obstructive pulmonary diseases (COPD) (RR:1.19, 95% CI:1.02 – 1.39), while cold temperatures were significantly associated with respiratory diseases (RR:2.44, 95% CI:1.56 – 3.82). An added effect of heat waves on childhood COPD was observed, while no added effect of cold spells was found. Conclusions: As climate change continues, children, especially those aged 0–4 years, are at particular risk for a variety of diseases which might be triggered by extremely hot temperatures.

Abstract Number	**P-3-12-13**
Presenter	Clara Tammy Kim, Ho Kim*, Hae-Kwan Cheong, Masahiro Hashizume, Yasushi Honda, Jinseob Kim, Yoonhee Kim, Jin-Hee Eum, Chisato Imai, Burmaajav Badrah
Exposure	drinking water
Health domains	infectious diseases
Type of research	time series study

Global climate change and waterborne diseases in Mongolia

Climate change and business activities have caused huge transformations in water reserves in Mongolia, specifically in the quality of water. In this study, we assessed the association between 2 major waterborne diseases—shigellosis and hepatitis A (Hep A)—in Mongolia and analysed the local and global climate factors. We obtained data on the incidence of waterborne diseases from 1996 to 2008 from the State Implementation Agency of Health. Regionally measured precipitation (mm) and average temperatures (°C) were analysed with the disease data. The NINO3 index and Dipole Mode Index (DMI) were selected as global climate variables. We analysed the relationship between waterborne disease and climate change using 3 different time-series models (Quasi-Poisson Generalized Linear Model): local climate model (LCM), global index model (GIM), and aggregated model. We used the year and season to control for secular trends with different moving average lags. We also estimated pooled effects of 5 sub-regions. In the LCM, significant increases were observed in the incidence of shigellosis as the temperature increased, whereas Hep A showed an opposite trend. In the GIM, Hep A showed a significant positive association with DMI and negative association with NINO3 in all sub-regions in Mongolia. A monthly mean temperature increase of 1°C resulted in an increase in the Hep A (pooled %change relative risk (RR): –2.19%, –2.65 to –1.73) and shigellosis (RR: 2.96%, 1.24 to 4.71) incidences. Every 10-mm increase in rainfalls decreased the RR for both diseases (–2.26% for Hep A and –1.23% for shigellosis). After controlling for local climate, DMI effects were positive in both diseases, and NINO3 effects were negative in both Hep A and shigellosis. However, the effects of temperature were different for the 2 diseases. Since Mongolia is an inland area, differences between the separate model and aggregated models are not large. Such models can help the health sector adapt to and protect the population from the impact of the climate change.

Abstract Number	**P-3-12-15**
Presenter	Jin-Hee Eum*, Hae-Kwan Cheong, Mina Ha, Ho Kim, Yasushi Honda, Masahiro Hashizume, Jinseob Kim, Clara Tammy Kim, Yoonhee Kim, Kasis Inape, Chisato Imai
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Impact of climate variability on the low birth weight in Papua New Guinea

Pregnant mothers and children are vulnerable population to environmental hazards including climate change.The climate related the burden of disease have greater influence among the children in comparison to other age groups. Maternal exposure with climatic variation can be reflected to the birth outcome through various mechanisms including nutritional factors related to food shortage, altered opportunity for infectious diseases, and exposure to extreme weather events. Although the relationship between climate variability on the birth weight of children has been reported from many areas of globe, there are few researches giving a quantitative assessment of climate variability on birth outcome.This study aims to evaluate the effects of climatic factors on the incidence of low birth weight of infant in the tropical area.The primary data was the monthly number of cases from 1996 to 2009 over six areas. Health outcome data was obtained based on the National Health Information System of National Department of Health and local climatic factors, such as monthly rainfall, monthly mean of the daily maximum temperatures, from at the National Weather Service. For the regional climate factors, we used the southern oscillation index (SOI) and the dipole mode index (DMI) to represent El Niño–Southern oscillation and Indian Ocean Dipole. We used generalized linear model to estimate the association between the monthly cases of low birth weight and climate variability after adjusted potential confounders, season and year.We found a linear relationship between low birth weight and climate variability after adjusting for potential confounders. We observed in regional model, there are local and regional climate factors, SOI and DMI had significantly negative relationship with low birth weight. The maximum temperature was significantly positive, but the rainfall was not significant predictor of the low birth weight.These findings suggest that the number of low birth weight cases had a linear relationship with climate variability originated from global oceanic environment.

Abstract Number	**P-3-12-16**
Presenter	Mathilde Pascal*, Vérène Wagner, Magali Corso, Karine Laaidi, Aymeric Bun Ung, Christophe Declercq
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Impact of extreme temperatures on mortality in nine French cities: evolution between 2001 and 2009

Background and aims:In France, past major heat waves have been characterized by an excess mortality. A national prevention plan was implemented in 2004, and its contribution to the reduction of the health impact is still to be determined. As the plan includes measures targeted on very warm days, we assessed if the mortality response during these very warm days has changed over time. Methods: The analysis was performed in nine large French urban areas, for the period 2001-2009. August 2003 was excluded from the analysis. The associations between temperature and non-accidental mortality were investigated using a generalized additive Poisson regression model. The mean temperatures at lag 0 and 1-7 were introduced as natural splines with 3 degrees of freedom. We assessed the percent increase in mortality during the 1% warmest days compared to the 10% warmest days for the period 2001-2003 with no heat prevention plan, 2004-2006 (first period of the heat prevention plan) and 2007-2009 (second period of the heat prevention plan). A similar analysis compared the 1% coldest days to the 10% coldest days. City specific results were combined using random effect models. Results: Mean temperatures in the nine French cities were similar over the three periods, with less important heat waves during 2007-2009. A mean difference of 4.6°C was observed between very warm and warm days (5.4°C between very cold and cold days). During 2001-2003 and 2004-2006, the mortality differences between very warm and warm days were similar: 7% [4:11] and 7% [5:9]. It decreased to 3% [0:6] during 2007-2009. A 3% difference was observed between very cold and cold days during the first periods. It increased to 6% [3:10] during 2007-2009. Conclusions: Despite the heat prevention plan, mortality remains higher during very warm days compared to warm days. A decrease was observed in 2007-2009 maybe due to the absence of sustained heat episodes. The analysis will be extended to a longer period and 7 more cities to better reflect the geographic and climatic variability.

Abstract Number	**P-3-12-17**
Presenter	Anna Páldy*, János Bobvos
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Impact of heat waves on excess mortality in 2011 and 2012 in Hungary

Background/Aims: According to the IPCC the rate of excess mortality due to the increased number of heat waves in relation to climate change can be predicted in the future in Europe. In this study we analyse the heat related excess mortality of the last two years with special care taking into account extreme summer of 2007 in Hungary. Methods: Daily temperature data were gained from the Hungarian Meteorological Service. The daily all cause mortality data at a weekly frequency were provided by the Central Office for Administrative and Electronic Public Services. Excess mortality was calculated for the country, for Budapest and for the seven regions as the difference of the daily mortality on days with mean temperature >25°C and >27°C (2nd and 3rd level of heat alert) and the average mortality on cooler days in the summer periods of 2011 and 2012. Excess mortality was computed also by age groups and sex. Results: In 2011, excess mortality was 5.4% on country level during the 2nd level heat alert, and 17.4% during the 3rd level. The highest excess mortality was 23% in the Central Hungarian Region. 593 excess death cases were registered during the 14 days of heat alerts in 2011. In 2012 the excess mortality was 33% in the Capital during the 3rd level of heat alert (13 days). 1666 excess death cases (27%) could be attributed to the 26 days of the four heat alerts at country level. In both years female mortality during the heat alerts was higher, the difference was bigger during the 3rd level of alerts. The mortality of 0-64 and 65-74 years was very similar, while almost twice as much elderly died during the heat alerts than in the younger age groups. Conclusion: In spite of the heat alert system in Hungary, the intensive heat waves cause great number of excess deaths with a maximum 2012 (1666 cases) during the last 10 years. More effective measures are necessary to decrease heat related excess mortality. The study was supported by the project PHASE - Public Health Adaptation Strategies to extreme weather Events - DG-Sanco 20101103.

Abstract Number	**P-3-12-18**
Presenter	Amy Sapkota*, Chengsheng Jiang, David Blythe, Amir Sapkota
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Increased Frequency of Unusually Hot Days and Foodborne Illness in Maryland

Background: The frequency and intensity of climate change related extreme weather events are on the rise. How such extreme weather events are related to foodborne illness is of utmost importance to local and state health departments to devise meaningful adaptation strategies for the future. Objective: We investigated the association between Increased frequency of unusually hot days and the risk of salmonellosis among Maryland residents. Methods: Using weather data from 1960-1980 as a baseline, we computed county level exposure metrics. These included “exceedence days” defined as the number of days within a given month that exceeded the 90th percentile of the distribution of maximum temperatures (Tmax) for the baseline period (1960-1980). We assigned these exposure metrices (for Tmin, Tmax and precipitation) to culture-confirmed cases of salmonellosis for the 2000-2010 period. The county level case data were linked with the corresponding demographic data and extreme weather events using R. The Generalized Least Squares (GLS) model was applied between the monthly case data and extreme weather events at the county level while controlling for temporal and spatial correlation. Results: There were 7,807 total culture-confirmed Salmonella cases for the study period, with February and July having the lowest (39) and highest (130) monthly totals, respectively. We observed higher rates of salmonellosis among children and African Americans. Counties experiencing higher level of “exceedence days” for maximum temperature had higher incidence of salmonella cases ($b = 0.07$, $p<0.05$). This association was stronger during the summer months compared to winter. Conclusion: In Maryland, increases in the incidence of salmonellosis may be related increased frequency of unusually hot days. However, these increases are not uniform across all sub-populations. Identifying the vulnerable populations and localities will be important in formulating meaningful adaptation strategies for the future.

Abstract Number	**P-3-12-19**
Presenter	Rebekah Lucas*, Tord Kjellstrom, Vidhya Venugopal, Olivia Hyatt, Bruno Lemke
Exposure	climate change (temperature)
Health domains	healthrelated quality of life
Type of research	health impact assessment

Mapping environmental heat stress variables in relation to climate change: examples from India

Background:The impact of heat stress on the health and productivity of the work force is substantial, particularly in tropical countries such as India where the current climate already puts workers at their physiological limit. Negative health impacts in the form of heat stroke and work capacity reductions are commonly reported in local Indian occupational health studies. Climate change modeling shows that global temperatures will increase in the future. Mapping of spatial and monthly heat exposures distributions now and in the future can provide important input into environmental and occupational health protection programs. Aim: The aim of this study was to determine the current and future impacts of heat stress on Indian populations using Wet Bulb Globe Temperature (WBGT) distributions maps. Methods: Grid cell based data on current and future modeled climate variables from CRU (Climate Research Unit, University of East Anglia) were used to calculate WBGT and create maps of WBGT distributions in India for different months and years. Results: WBGT distribution maps indicate that in 2005, average afternoon WBGT levels (indoors or in full shade) were above 26 oC for the majority of India, with values up to 33-34 oC in some places. By comparison, 2050 maps indicate average afternoon WBGT levels above 28 oC for large parts of India, with values up to 35 oC possible in some places. Conclusions: Current heat exposure levels in India are already higher than occupational heat guidelines recommend for worker health and productivity. Tropical and sub-tropical countries, such as India, with large working populations are particularly susceptible to the negative impacts of climate change. Mapping heat exposure based on climate modeling outputs can be a useful tool for national and local health programs, as such maps can indicate where heat stroke risk is likely to increase.

Abstract Number	**P-3-12-20**
Presenter	Lora E. Fleming*, Brian Golding, Anthony Kessel, Andy Haines, Michael H. Depledge, Dan Bloomfield, Anna Cichowska, Shakoor Hajat, Christophe Sarran, Nicholas Osborne, Clive Sabel
Exposure	climate change (temperature)
Health domains	other
Type of research	others

MED-MI: Linking Human Health and Wellbeing with Weather, Climate, and the Environment

A large part of the global disease burden can be linked to environmental factors, underpinned by unhealthy behaviours. However, research into these linkages suffers from the lack of common tools and databases for carrying out investigations across many different scientific disciplines to explore these complex associations. The MED MI Partnership brings together leading organisations and researchers in climate, weather, environment, and human health and wellbeing. The main aim is to create a central data and analysis source as an internet-based Platform which will be a vital new common resource for medical and public health research in the UK and beyond. We will link and analyse complex meteorological, environmental, and epidemiological data. This is a vital step to translate this data and analysis resource into epidemiologic, clinical, and commercial collaborative applications, and thus, improved human health and wellbeing in a rapidly changing environment. Translational applications will: · facilitate novel research into environmental exposures and health using integrated models; · rapidly identify “hot spots” for targeted prevention, interventions, and research; · provide healthcare practitioners, public health planners, and environmental managers with relevant information for improving services for locations and populations identified at risk; · initiate and evaluate interventions to reduce the exposures, and thereby the health effects at both the individual and population levels; · disseminate and provide access to data as part of outreach and engagement with the research community, policymakers and civil society. Existing databases, currently stored in various locations/organizations, will be combined enabling climate, weather and environment data to be linked and analysed with human health and wellbeing data. With appropriate confidentiality and ethical safeguards, the Platform will be available to UK and other researchers.

Abstract Number	**P-3-12-21**
Presenter	Dinar Yarani*, Mu-Jean Chen, Huey-Jen Su, Titik Respati, Asep Sofyan
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	time series study

Precipitation Impacts on Dengue Fever Incidence: Case Study in Indonesia and Taiwan

Background: Dengue is one significant public health burden in both Indonesia and Taiwan. High time for dengue outbreak is reported on rainy season while rainy season varies in these areas, suggesting that precipitation is likely to exert potential impact on dengue fever outbreak of tropical and/or subtropical region. Aims: This study aims to assess the precipitation impacts on dengue fever incidence in two tropical cities: Bandung, Indonesia and Kaohsiung, Taiwan. Methods: Monthly and daily dengue incidence data, average temperature, relative humidityand precipitation from Bandung in Indonesia and Kaohsiung in Taiwan from 1998 to 2010 were analyzed respectively. Time-series analyses with generalized additive model were utilized to evaluate the association between weather factors and dengue fever incidence. The estimated relative risks (RRs) were adjusted for year and rainy season (There were defined rainy seasons from November through March in Indonesia and April through October in Taiwan). Each weather factor was investigated for month lag of 0-2 in Indonesia and day lag of 0 to 70 in Taiwan for disease' incubation period. Results: In Bandung and Kaohsiung, an increase in 30 mm precipitation at 2 month prior and 49 days prior were associated with a 5.7% ($p<0.001$) increase in and a 6.7% ($p=0.003$) decrease by dengue incidence,respectively. Comparing with drought season, there was a significantly increasing risk in Bandung while a negative risk for Kaohsiung in rainy season. An increase in every 1 oC temperature at 2 month prior and 49 days prior may significant rise a 2.7% ($p<0.001$) and 26.7% ($p<0.001$) of dengue incidence in Bandung and Kaohsiung, respectively. Furthermore, 1% relative risk increases could increase 4.4%-5.0% ($p<0.001$) risks of dengue incidence in both areas. Conclusions: Precipitations and rainy season appear to impose opposite effects for dengue incidence in Bandung and Kaohsiung where the exact underlying mechanism warrants further studies.

Abstract Number	**P-3-12-22**
Presenter	Jaime Iván Gutiérrez-Avila*, Magali Hurtado-Diaz, Stephen Rothenberg, José Luis Texcalac Sangrador, Horacio Riojas Rodríguez
Exposure	climate change (temperature)
Health domains	respiratory disease
Type of research	time series study

Respiratory mortality related to temperature and air pollution in Mexico City during 1998- 2009

Respiratory mortality related to temperature and air pollution in Mexico City during 1998- 2009 Gutiérrez-Ávila Jaime Iván, Hurtado-Díaz Magali, Rothenberg Stephen J., Texcalac-Sangrador José Luis, Riojas-Rodríguez Horacio Abstract Background. Studies carried out mainly in developed countries have evaluated the association between temperature variations on mortality. Physiographic and climatic characteristics of Mexico City increase its population's vulnerability to suffer respiratory effects related to temperature and air pollution. Methods. We used Poisson generalized linear models (GLM) with penalized splines to evaluate the association between minimum apparent temperature and mortality for respiratory causes on different age groups in Mexico City during 1998-2009. Models were adjusted for air pollutants (PM10, O3, NO2 y SO2), weekdays, holidays and season. We used distributed lags of temperature and air pollutants to model the exposure. Results. Decreased all-age, all-cause respiratory mortality of -2.09% (95% CI:-3.63, -0.53) was associated with every 1% increase in temperature 3 days earlier and each 1% increase in the concentration of PM10 was associated with a 4.57% (95% CI: 1.27, 7.97) increase on mortality on the same day. Among people over 65 years mortality due to chronic respiratory diseases decreased -3.14% (95% CI:-5.98, -0.21) with every 1% increase in temperature 4 days earlier and mortality related to PM10 increased 6.04% (95% CI: 0.55, 11.84) with every 1% increase on the same day. Lower respiratory disease mortality among children under 1 year decreased -22.65% (95% CI: -35.10, -7.83) with every 1% temperature increase on the same day. Conclusions. Increase in minimum apparent temperature was associated with decreased respiratory mortality during 1998-2009 in Mexico City. The particle pollution levels represent a risk factor for respiratory mortality. Key words: Apparent temperature, respiratory diseases, mortality, air pollution, distributed lags.

Abstract Number	**P-3-12-23**
Presenter	Sophia Rodopoulou*, Evangelia Samoli, Antonis Analitis, Richard Atkinson, Francesca de Donato, Klea Katsouyanni
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Searching the best expression variable of temperature effect on health in three European cities.

Background: The adverse health effects of temperature have been studied during the past decades and excess heat or cold has been associated with increased mortality. However, there is ongoing debate on the temperature index that best describes its effect. Aims: We used time-series from 3 European cities (Athens, London and Rome) within 1999-2005 to evaluate the temperature index and lag structure by season thatmost adequately predicts mortality. Methods: City-specific Poisson regression models controlling for seasonality and other confounders were used separately for winter (October-March) and summer (April-September) to examine the association between temperature and mortality.Based on previous results linear temperature terms for winter and threshold terms for summer were used. Mean, minimum and maximum temperature adjusting for humidity, and the same measures for apparent temperature under different lag structures were compared. The best city-specific measure was determined by the models' Akaike Information Criterion, Generalized Cross-Validation, residual serial correlation and by the best prediction of mortality. Results: In winter, the more adequate index was the minimum daily temperature for London and Rome, with delayed effects up to 13 days (average of lags 0-13) and of 3 to 6 days (average of lags 3-6) respectively, while the mean temperature lagged up to 13 days (average of lags 0-13) predicts better the mortality in Athens. In summer, the mean daily temperature lagged up to 3 days (average of lags 0-3) was the best index for Athens and Rome, while maximum apparent temperature with the same lag structure provided a better fit for London's mortality. Conclusions: Our results suggest that the effects of temperature are more prolonged in winter and more acute in summer regardless of index used. Although the optimal index is modified by the city-specific meteorological characteristics, air temperature performed slightly better than apparent in most cases.

Abstract Number	**P-3-12-24**
Presenter	Eunil Lee*, Suji Lee, Bo Yeon Kwon, Deaho Jung, Kyunghee Jo, Man sik Park, Hana Kim
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	time series study

Short term effects of temperature on emergency admission of myocardial infarction in Korea with the thresholds of hot and cold temperatures

Background A number of studies have examined the influence of meteorological factors on myocardial infarction(MI) incidence. And there have been few studies to assess the differences of temperature threshold for increased risk of MI with the regional effects (central or south region of Korean Peninsula), MI status including ST-segment elevation myocardial infarction (STEMI) and non STEMI or aging effects. Methods We used the climate variables from the Korea Meteorological Administration, air pollution data provided by Korea National Institute of Environmental Research and myocardial infarction admission data from the KAMIR (Korea Acute Myocardial Infarction Registry) team. We estimated the temperature-MI relation by using generalized additive models (GAMs) and the relations were adjusted by humidity, pressure of sea level, PM10 and NO2. Results The threshold of mean temperature in hot weather was 28.5℃, and emergency admissions increased by 23% (95% CI: 0.4%-50%) and 30% (95% CI: 3%-64%) with increase of 1℃ above the threshold in STEMI group and Non-STEMI group respectively. However, the threshold of mean temperature in cold weather was -1.5℃ with 1% or 2% decrease below the threshold in STEMI or non-STEMI group. Old age group (above 75 years old) showed increase of 12% (95% CI: 6%-18%) of admission with increase of 1℃ above the threshold of maximum temperature (31.5℃) which is greater than 6% (95% CI: 3%-9%) in young age group (below 75 years old). There were differences of temperature threshold between central and south regions in both hot and cold weather. The thresholds of mean temperature in hot weather were 19.5℃ and 21.5℃ in central and south region respectively, and those of minimum temperature in cold weather were -1.5℃ in central region and -2.5℃ in south region. Conclusions We found the variable threshold effects of temperature to increase the risk of MI in hot and cold weather with regional and aging effects. More researches should be done to assess the risk of MI by temperature changes with protective or aggravating factors.

Abstract Number	**P-3-12-25**
Presenter	Thuan Quoc Thach*, Poh-Chin Lai, Patsy YK Chau, Qishi Zheng, Crystal CY Choi, Heiko Jahn, Dietrich Plaß, Alexander Krämer, Lutz Katzschner, Chit-Ming Wong
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	health impact assessment

Spatial associations between thermal stress and mortality in Hong Kong

Background: Physiological equivalent temperature (PET) has been developed to quantify thermal stress from the environment. Compared to the studies on the associations between PET and health outcomes based on temporal variations, studies based on spatial variations remain scant. Aims: To assess associations between mortality and PET among small geographical areas in Hong Kong. Methods: PET values of year 2006 were calculated for 145 Tertiary Planning Units (TPU), which are the smallest geographical demarcations for urban planning, frommeteorological and geographical variables. Standardized mortality rate(MR) was computed from mortality and demographic data from Census and Statistics Department in the same year. We assessed spatial correlations between MR and PET by means of bivariate Moran's I and identified the hot and cold spots for the TPU using Local Indicators of Spatial Association (LISA) analysis. Scatter plots of MR against annual mean PET were produced for three regions: Hong Kong Island (HKI), Kowloon (KL) and New Territory (NT). Results: The bivariate Moran's I was 0.2533, indicating positive autocorrelation between MR and PET. Using LISA analysis, hot spots (i.e. TPU with high MR are surrounded by TPU with high PET) were identified in areas of high population density. Linear-like patterns exhibited in all regions in that TPU with higher PET tend to have higher MR. In particular, PET in HKI were at the range from 26.3 to 31.3 °C, while NT (with large green areas) and KL (with the majority of high population density areas) were from 26 to 30 °C and 28 to 31.3 °C, respectively. Furthermore, outliers in the scatter plots with relatively higher MR than expected were mostly found in hot spots. Conclusions: There exist spatial variations in the associations between mortality and PET in Hong Kong. Further studies based on individual characteristics, which are not subject to ecological fallacy, are needed to clarify the spatial associations.

Abstract Number	**P-3-12-26**
Presenter	Rupa Basu*, Lillian Sie
Exposure	climate change (temperature)
Health domains	reproductive outcomes
Type of research	case-crossover study

Temperature and neonatal mortality in California, 1999-2007

Background: Temperature and mortality among the elderly has been widely studied. Infants have been far less researched but also lack thermoregulatory response to heat exposure. Neonates up to 28 days following birth represent the most vulnerable infancy period. Aim: To examine the association between mean daily apparent temperature, a combination of temperature and humidity, and neonatal deaths. Methods:We applied the time-stratified case-crossover study design to neonatal deaths reported by the California Vital Records occurring during the warm season of May through October from 1999 through 2007. The study population included 6,564 cases residing within twenty kilometers of meteorologic monitors. We considered possible effect modification by region, cause of death, and race/ethnic group, and potential confounding by air pollutants. Results: For all-cause mortality, coastal areas were more impacted than non-coastal areas for most causes of death (excess risk 7.12% per 10˚F same-day apparent temperature; 95% confidence interval [CI]: -9.82, 24.34 in coastal areas versus 0.49%; -5.60, 6.63 in non-coastal areas). The most notable significant positive association was found for circulatory causes in coastal areas (234.52%; 46.25, 456.66), while respiratory diseases and short gestation duration also had positive impacts. Temperature effects appeared to be greatest for Blacks (11.06%; -3.44, 25.77) for all-cause mortality, although risk varied by race/ethnicity and disease subgroup. Asian neonates, for example, had a significant association with deaths from respiratory causes (136.69%; 19.43, 267.44). Risks remained independent of air pollutants. Conclusions:High temperatures were associated with an increase in neonatal deaths. Region and race/ethnicity modified the association.

Abstract Number	**P-3-12-27**
Presenter	Yu-Chun Wang*, Yu-Kai Lin, Fung-Chang Sung
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	time series study

Temperature effects on Emergency Room Visits for Metabolic Syndrome-Related Diseases, Cardiopulmonary Diseases and Accidents in Taipei Metropolitan

Aims: The present study evaluated emergency room visit (ERV) risks for cerebrovascular diseases, heart diseases, ischemic heart disease, hypertensive diseases, chronic renal failure (CRF), diabetes mellitus (DM), asthma and chronic airway obstruction not elsewhere classified (CAO) and accidents associated with temperature from 2000 to 2009 in Taipei metropolitan. Methods: A distributed lag non-linear model was used to estimate the cumulative relative risk (RR) and confidence interval (CI) of cause-specific ERVs associated with temperatures (0 to 3-day lags), extreme heat and cold lasting for 3 days or longer after controlling for effects of PM10, NOx and O3 and potential confounders. Results: Temperatures for lowest ERVs risk were 27-30°C for cardiopulmonary diseases and around 18°C for CRF, DM and accidents. Low temperatures were associated with higher ERV risks than high temperatures for cerebrovascular and hypertensive diseases and asthma that cumulative 4-day RR were 1.56 (95% CI: 1.23, 1.97), 1.78 (95% CI: 1.37, 2.34) and 2.93 (95% CI: 1.26, 6.79), respectively, in the environment of 14°C. In the environment of 32°C, RRs for ERVs were 1.69 (95% CI: 1.01, 3.58) for CRF, 1.69 (95% CI: 1.09, 2.61) for DM and 1.19 (95% CI: 1.11, 1.27) for accidents at lag 0 day; moreover, cumulative 4-day RR were significant for ERVs of CRF (RR= 2.36; 95% CI: 1.33, 4.19) and accidents (RR= 1.23; 95% CI: 1.14, 1.33). Effects from cold temperature were greater after lag 1 day. Prolonged extreme cold event was associated with elevated ERV of asthma. Conclusions: Elevated ERVs of CRF, DM and accidents associated with high temperature. ERVs of cerebrovascular and hypertensive diseases and asthma increased as temperature decreased.

Abstract Number	**P-3-12-28**
Presenter	Dan Zhao, Zhongjie Li, Yonghui Zhang, Wenwu Yin, Tie Song, Jianfeng He, Shengjie Lai*, Archie Clements, Wenbiao Hu, Weizhong Yang
Exposure	no exposure
Health domains	infectious diseases
Type of research	time series study

The effects of imported cases, climatic variability and vector population on dengue fever in Guangzhou City, China

* Dan Zhao, Zhongjie Li and Yonghui Zhang contributed equally * Correspondence: Weizhong Yang: ywz126@vip.sina.com; Wenbiao Hu: w.hu@sph.uq.edu.au Background Dengue fever (DF) has been recognised as the most important arboviral disease in the world. Nearly 1.8 billion people are estimated to be at risk of DF. DF occurred frequently in Guangdong, China. Evaluating the risk of DF transmission could contribute to the surveillance and early warning system. However, the relationship between the risk posed by infected travelers, climate and vectors was still unclear. Aims The research aims to explore the impact of imported cases, climatic variability and vector population dynamics on DF transmission in Guangzhou City, China. Methods Data on climate factors, vector surveillance and notified DF cases in Guangzhou City from Jan 2001 to Dec 2010 were collected. Multiple logistic regression modelandtime series negative binomial model were used to assess the associations between climate factors, vector, imported DF cases and indigenous DF cases. Results Our results showed that indigenous cases (Odds Ratio (OR):8.3;95%CI:2.6-26.3), imported cases(OR:1.6; 95% CI:0.8-3.1) and average atmospheric pressure(OR:0.7; 95% CI:0.6-0.9) at a lag of 1 month, as well as average relative humidity(OR:1.5;95%CI:1.1-2.1), Breteau Index of mosquitoes(BI)(OR:1.4; 95% CI:1.1-1.9), and total precipitation(OR:0.9; 95%CI:0.9-1.0) at a lag of 2 monthswere associated with the occurrence of indigenous cases. Minimum temperature(Relative Risk(RR):1.5;95%CI:1.2-1.8), average relative humidity (RR:1.3;95%CI: 1.2-1.5) and BI (RR:1.11; 95%CI:1.0-1.2) at lag of 1 month, as well as minimum relative humidity at a lag of 2 months (RR:1.3; 95% CI:1.2-1.4) were associated with the incidences of indigenous DF cases. Conclusions The DF transmission was affected by a combination of climate factors, density of vectors and imported cases in Guangzhou City, China.These findings may have applications as a decision support tool in planning disease control and risk-management programs for DF.

Abstract Number	**P-3-12-29**
Presenter	Wonwoong Na*, Jae-Yeon Jang, Kyung Eun Lee, Hyunyoung Kim, Byungyool Jun, Jun-wook Kwon, Soo-nam Jo
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

The effects of temperature on heat-related illness according to characteristic of patients during the summer of 2012 in Republic of Korea

Background Damages caused by heat waves are expected to be on the rise with climate change. Accordingly, heat-related morbidity and mortality are likely to grow significantly. Nevertheless, the pattern of incidence of heat-related illnesses and its relationship with temperature have rarely been investigated. Aims This study was conducted to investigate the relationship between heat-related illnesses developed in the summer of 2012 and temperature. Methods The study analyzed data generated by a heat wave surveillance system operated by the Korea Centers for Disease Control and Prevention during the summer of 2012. The daily maximum temperature, average temperature, and maximum heat index were compared to identify the most suitable index for this study. A piecewise linear model was used to identify the threshold temperature and the relative risk (RR) above the threshold temperature according to patient characteristics and region. Results The total number of patients during the 3 months was 975. Of the three temperature indicators, the daily maximum temperature showed the best goodness of fit with the model. The RR of the total patient incidence was 1.691 (1.641 to 1.743) per 1°C after 31.2°C. The RR above the threshold temperature of women (1.822, 1.716 to 1.934) was greater than that of men (1.643, 1.587 to 1.701). The threshold temperature was the lowest in the age group of 20 to 64 (30.4°C), and the RR was the highest in the ≥65 age group (1.863, 1.755 to 1.978). The threshold temperature of the provinces (30.5°C) was lower than that of the metropolitan cities (32.2°C). Metropolitan cities at higher latitudes had a greater RR than other cities at lower latitudes. Conclusion The influences of temperature on heat-related illnesses vary according to gender, age, and region. A surveillance system and public health program should reflect these factors in their implementation.

Abstract Number	**P-3-12-30**
Presenter	Bettina Menne, Aliya Kosbayeva*, Andrj Gribrovski, Melitta Vujnovic
Exposure	climate change (temperature)
Health domains	cardiovascular disease
Type of research	time series study

The public health consequences of climate change in Kazakhstan: an epidemiological assessment

Background. The climate in Kazakhstan has become warmer. The air temperature has increased on average by 0.31°C every 10 years for the period 1936-2005. According to various climate change scenarios, it is possible that Kazakhstan may experience a change in its geographical zones, an increase in arid zones and in the shortage of water resources, and a deterioration in conditions for agriculture. Objectives. The objective of the project was to carry out a vulnerability assessment (h(VIA))and to use the evidence to develop a health national adaptation plan (hNAP). Methods. A variety of qualitative and quantitative methodologies, were used, according to WHO methods to assess the health effects of climate change and to assess health system preparedness. Literature reviews, interviews, focus group, time series and regression analysis, vulnerability risk assessment methods, and stakeholder engagement were the main. Results.Impacts of climate change are not uniform across the country. Population health in South Kazakhstan, North Kazakhstan and Zhambyl region (located in the south, southeast and north of Kazakhstan) are projected to be most at risk. In Astana (the capital) an increase of ambient temperature by 1°C during the warmer months is associated with an increase in deaths from cerebrovascular disease and higher monthly incidence of salmonella infection The increase in average annual temperature will establish optimum conditions for expansion of the habitat of Ixodes tick vector. Conclusion.The h(VIA) process facilitated a greater focus on the role of climate change and the need for adaptation measures to promote health and health sector resilience. As a follow up a range of adaptation measures have been identified which are currently under government revisions.

Abstract Number	**P-3-12-31**
Presenter	Hwanjin Park*, Jaechul Song, Jaeyoung Kim, Inah Kim, Clara Tammy Kim
Exposure	climate change (temperature)
Health domains	allergies
Type of research	health impact assessment

The relationship of climate change, pollen count and occurrence of rhinitis

The relationship of climate change, pollen count and occurrence of rhinitis Authours Hwanjin Park, Department of occupational and environmental medicine, Hanyang University College of Medicine, Seoul, Korea Jaechul Song, Department of occupational and environmental medicine, Hanyang University College of Medicine, Seoul, Korea Jaeyoung Kim, Department of occupational and environmental medicine, Hanyang University College of Medicine, Seoul, Korea Inah Kim, Department of public health, Yonsei University School of Public Health, Seoul, Korea Clara Tammy Kim, School of public health, Seoul National University, Seoul, Korea Background: Climate change has effects on allergic diseases. It may be due to the change of pollen. However, in Korea, a few studies have been performed to characterize the correlation of climates change, pollen, and allergic disease using national data. Aims: To characterize the correlation of climate change, pollen count and rhinitis. Methods: All rhinitis cases of Korea (2006~2010) composed of J30.1~J30.4 from ICD-10 code were counted in the Reports of National Health Insurance Corporation. Temperature, precipitation and three area (Seongdong-gu, Guri, & Jeju) pollen counts (weekly added value of Birch, Alder, Oak, Ragweed, Wormwood, Japanese hop, Grass, Hazel) were provided by National Institute of Meteorological Research, and air pollution data (CO, NO2, O3, PM10, SO2) by National Institute of Environmental Research. We used General Additive Model to see relative risk of occurrence of rhinitis. Other meteorological and air pollution data were adjusted. Results: Number of rhinitis reported for five years in Korea is 213,406,820 and increasing every year. Occurence of rhinitis was associated with Oak, Ragweed, Birch in Seongdong-gu, Grass, Ragweed, Hazel in Guri, and Alder, Hazel, Oak in Jeju in order. Conclusions: Due to the climate change, occurrence of rhinitis in Korea is increasing every year and associated with pollen counts. Differences of the pollen effects by area would be due to the latitude of the region.

Abstract Number	**P-3-12-32**
Presenter	Inah Kim*, Hwanjin Park, Jaechul Song, Jaeyoung Kim, Clara Tammy Kim
Exposure	climate change (temperature)
Health domains	allergies
Type of research	health impact assessment

The relationship of pollen count and occurrence of asthma

Background: Asthma is typical allergic disease and incidence rate is increasing. Some cause of increase may be due to pollen change related with climate change. However, in South Korea, a few studies have been performed to explain the correlation of climates changes, pollen count, and allergic diseases using national data such as National Health Insurance Corporation. Objective: The aim of this ecological study was to characterize the correlation of pollen count and asthma which is typical allergic disease in South Korea. Method: All asthma cases of South Korea (2006~2010) composed of J45.0 and J45.9 from ICD-10 code were counted in the Reports of National Health Insurance Corporation. Meteorological data (average temperature and precipitation), and three area (Seongdong-gu, Guri, & Jeju) pollen counts (weekly added value of Birch, Alder, Oak, Ragweed, Wormwood, Japanese hop, Grass, Hazel) were provided by National Institute of Meteorological Research, and air pollution data (CO, NO2, O3, PM10, SO2) by National Institute of Environmental Research. We used General Additive Model to see relative risk of occurrence of asthma, when weekly pollen count is more than 10 compared to less than 10. Other meteorological and air pollution data were adjusted. Results: Number of asthma case is increasing every year from 2006 (6,939,178) to 2010 (15,633,105). Total count of asthma for five years is 65,602,525. Occurence of asthma was increased with pollen counts of Oak, Birch in Seongdong-gu, Grass, Hazel, Oak in Guri, and Alder, Oak, Hazel, Birch. But some pollen count increase was shown to reduce occurrence of asthma. Conclusion: Occurrence of asthma in South Korea is increasing every year and may be associated with some pollen counts. Some pollen decreased asthma occurrence. Maybe pollen in addition to a variety of causes affect occurencece of asthma. Difference of the pollen effects by area would be due to the latitude of the region.

Abstract Number	**P-3-12-33**
Presenter	Nirandeep Rehill, Ben Armstrong*
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

USING TIME SERIES OF ANNUAL DEATH COUNTS TO OBTAIN HARVESTING-RESISTENT ESTIMATES OF TEMPERATURE-MORTALITY ASSOCIATIONS

Background and Aims: Daily time series regression analyses have proved powerful ways to identify acute effects of temperature extremes and of air pollution, but associations may reflect just short term displacement of deaths ("harvesting"). To avoid this we apply time series methods to associate annual deaths counts with annual summaries of temperature extremes. We illustrate the method by application to impacts of low and high temperature in London 1949-2006. Methods: Analysis units were Sept-Aug years (n=57), for which total deaths (Y) and summaries of cold and heat (X: means degree-days less and more than 18oC daily mean respectively) were obtained. The 18 degree threshold was based on the minimum mortality temperatures in previous daily time series studies. The coefficient of the cold and heat variables was estimated using an overdispersed Poisson GLM. Secular trends were modeled using splines with 5 degrees of freedom and influenza by including count of pneumonia and influenza deaths (linear term). Results: The estimated increase in total annual mortality per degree was 2.3% (95%CI 0.6,4.1) for cold and 1.6% (-4.1%,8.1%) for heat. Sensitivity analyses showed similar results for a range of alternative model choices including more flexible secular trends, negative binomial regression, indirect adjustment for black smoke, and different thresholds (15 and 21 degrees). Conclusions: In this London annual series we saw an association of cold with mortality which was broadly similar in magnitude to that found in daily studies, suggesting that most deaths due to cold were displaced by at least six months. The estimated association with heat was imprecise, with confidence interval including magnitudes found in daily studies but also including zero. The imprecision reflects the smaller number of heat-related deaths in temperate London which makes this approach ineffective here to identify harvesting in deaths due to heat.

Abstract Number	**P-3-12-34**
Presenter	Haeyoung Pak*, Jongsik Ha, YongSeong Shin
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

Vulnerability assessment due to high temperature in Seoul, South Korea

Background Health impact of high temperature has been reported since the early 20th century. In South Korea, it is reported that mortality increases with temperature above city-specific thresholds during the hot season in Seoul. However, the health impact of high temperature according to vulnerability on morbidity has been inconclusive in South Korea. Objectives The goal of this analysis was to examine health impact of high temperature, according to vulnerability on morbidity in summer (May-September) Seoul, South Korea, from 2003 to 2010. Methods To examine the distributed lag effects, we fitted a constrained distributed lag model that included lagged exposure variables as covariates, applying a function of days of lag according to B-spline bases. In our study, morbidity data are episode data based on patients, with applying the episode of care in National insurance claim data. We examined heat stroke in two age categories: all ages and those over age 65, and low level of income, high region of deprivation. Results The summer temperature thresholds were 26.1°C in Seoul. A 1°C increase in temperatures above morbidity-specific thresholds was associated with increase in heat stroke episode counts for all ages, and for those over age 65 of 35.86% and 50.05%, 44.56% and 52.42% for low level of income, 42.28% and 62.62% for high region of deprivation. Associations were stronger for low level of income and high region of deprivation in heat stroke, to a lesser extent, total group. Conclusions Our study found that high temperature was associated increased risk of heat stroke, according to vulnerability in Seoul. Consequentially, evidence of this study has the potential to inform public health efforts, such as heat warning systems for differential high temperature according to vulnerability.

Abstract Number	**P-3-15-01**
Presenter	Gea Oliveri Conti*, Caterina Ledda, Maria Grazia D' Agati, Adriana Floridia, Roberto Fallico, Maria Rosaria Gallea, Salvatore Sciacca, Ferrante Margherita
Exposure	food
Health domains	cancer
Type of research	exposure measurement

A pilot study for exposure evaluation to mycotoxins in blood and urine.

Background Human exposure to mycotoxins occurs primarily through the consumption of contaminated food. There are still many uncertainties associated to the risk evaluation from exposure to mycotoxins and still do not know the cumulative real effect of mycotoxins on human health. Aims The assessment of exposure to mycotoxins of a healthy population by monitoring of these in blood and urine will allows to establish the exposure level and related risk, is therefore necessary to have analytical methods able to of determining concentrations of mycotoxins in traces. Liquid chromatography electrospray tandem mass spectrometry (LC-ESI-MS-MS), in this regard, is the most appropriate technique. Methods Has been developed an multiresidue method for the quantification of Ocratoxin A, Ocratoxin α, Deoxynivalenol, Nivalenol, Zearalenol, Fumonisins (B1, B2) Aflatoxins (Afla B1, B2, G1, G2, M1) Patulin, HT2 and T2. 10 samples of urine and blood were collected by healthy volunteers. For samples extraction have been used the β-glucuronidase, therefore the analytes were separated chromatographically by Waters XBridge C18 column and precolumn (5µm-2,1x150 mm; 5µm-2,1x10 mm respectively) with a LC-ESI-MS-MS-TQD Varian 320, finally, the data were processed using the Varian Workstation Version 6 software. Results The data obtained showed concentrations below the minimum of detection for all mycotoxins in blood and urine. 3 samples of blood were positive for Fumonisin B2 (a min. 0.35 to a max of 1.46 ppb), while their urine were positive for AflaB1 and B2 (0.30 and 1.42 ppb respectively). Conclusion The results have mycotoxins values below detection limit and this can be justified by more stringent limits (Reg.2377/90/CE) in food but especially by the imposition of analytical methods able to detect traces of mycotoxins in food (Decision 657/2002/CE). This method allow to estimate the real exposure of people to mycotoxins because it takes into account free and ghost mycotoxins, therefore allows a correct assessment of the risk.

Abstract Number	**P-3-15-02**
Presenter	Maria Fiore, Gea Oliveri Conti, Caterina Ledda*, Placido D'Agati, Adriana Floridia, Antonio Maieli Diaz, Giuseppe Covato, Roberto Fallico, Margherita Ferrante
Exposure	food
Health domains	other
Type of research	cross-sectional study

Adult's exposure to bisphenol A by biomonitoring

Background Bisphenol A (BPA) is a chemical used extensively to manufacture commonly used plastics and epoxy resin liners for food and beverage cans. Because the ester bonds in these BPA-based polymers are subject to hydrolysis, leaching of BPA has led to widespread human exposure. Although no clear association has been established between human exposure to BPA and adverse health effects, studies to investigate the prevalence of exposure are required because of BPA potential harmful effects. Aims Exposure was evaluated by urinary BPA levels in general adult population of the south Italy. Methods The subjects fill out a questionnaire to assess occupation, education, and lifestyle habits, such as tobacco smoking, alcohol consumption, and other common demographic data. Pooled 24 h urine samples were collected in polyethylene con-tainers and stored at –20°C until the analysis. Both free and total BPA were determined by HPLC/MS. Results Participants were adults non occupational exposed to BPA with mean age of 50±13.6 years, with mean weight of 68.7±13.9 kg, and mean height of 166.4±7.7 cm. Total BPA was observed above the LOQ in 61% of samples. The median concentration was 1.1 µg/L; the 95th percentile concentration was 30.3 µg/L. Free BPA was observed above the LOQ in 28% samples. The median concentration was 1.2 µg/L; the 95th percentile concentration was 5.3µg/L. Median daily BPA intakes for men are statistically significantly higher than for women; there is a significant decrease in daily BPA intake with increasing age. Conclusions The frequent detection of BPA suggests widespread exposure to this compound in residents of the south Italy. The daily human intake of BPA is <50 ug/kg bw/day (US EPA reference dose) like others studies. These doses, anyway can have an adverse endocrine disruptive effect on humans, especially fetuses, therefore others more detailed studies needed.

Abstract Number	**P-3-15-03**
Presenter	Stephen Van Den Eeden*, Yun Yun Gong, Charles Quesenberry, Jun Shan, Christopher Wild, Lawrence Engel
Exposure	food
Health domains	cancer
Type of research	case-control study

Aflatoxin serum levels and risk of hepatocellular carcinoma in a nested case-control study in the United States

Background Aflatoxin is one of the most powerful chemical carcinogens known. While it is well known that ingestion or exposure to high levels of aflatoxin is associated with a greater risk of hepatocellular carcinoma (HCC), particularly among chronic HBV carriers, no studies have examined this association in a low exposure region with exposure measured prospectively. Aims To address this gap, we conducted a nested case-control study within the Multiphasic Health Check-up (MHC) cohort at Kaiser Permanente Northern California (KPNC). Methods The study population was defined as the MHC participants who provided a serum sample between 1964 and 1985 with serum available. HCC cases (n=193) that occurred after MHC exam date were identified by linkage to the KPNC Cancer Registry. Controls (n=578) were randomly selected and matched to cases on age, sex, race/ethnicity and date of MHC exam (serum draw). Serum aflatoxin-albumin (AF-alb) adduct levels were determined by an enzyme-linked immunosorbent assay (ELISA) after albumin extraction, digestion and purification with the limit of detection at 0.5 pg AF-lysine equivalent per mg albumin. Results 118 participants had levels of AF-alb above the detection limit (16.1% of the cases and 15.1% of the controls). Among individuals with detectable levels, the range of AF-alb levels was 0.70 to 138.00 pg/mg. The majority of detectable levels were near the limits of detection, where the assay is least precise. Only a single case (0.5%) and 12 controls (2%) had levels >10.00 pg/mg. In a conditional logistic regression model, the odds ratio for having a detectable serum AF-alb level in relation to risk of HCC was 1.19 (95% confidence interval 0.76-1.87). Conclusions This study provides no evidence that low exposure levels of aflatoxin found in this U.S. sample are associated with

Abstract Number	**P-3-15-04**
Presenter	Rajarajeswari Kuppuswamy*, Sumathi Swaminathan, Padmavathi Ramaswamy, Thangavel Gurusamy, Vidhya Venugopal, Kalpana Balakrishnan, Kaleeswari Gunasekaran
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	cohort study

Assessment of nutritional status in a pregnant women cohort examining health effects of air pollution: Preliminary results from the SICAPHE study

Background: Few efforts have been undertaken to objectively assess nutritional status in pregnant women, especially within environmental health studies in developing countries. We report preliminary results from nutritional assessments in the newly established South Indian Cohort for Air Pollution and Health Effects (SICAPHE) study aimed at generating exposure-response relationships for air pollution and select birth/early childhood outcomes. Aim: Development and validation of a food frequency questionnaire (FFQ) for nutritional assessments in a pregnant mother cohort in south India. Methodology: We administered a 24-hr dietary recall questionnaire to sub-set of pregnant women enrolled in the SICAPHE study (n=100 out of total cohort enrollment of 1200) to develop a food list, conducted a market survey to seasonality in availability and developed standardized instrument for assessing portion size. Based on these food frequency questionnaire was developed assess macro and micro-nutrient intakes against recommended nutritional requirements (developed by the Indian National Institute of Nutrition). . Results: Initial analyses (n= 156) indicates inadequate intake of milk and milk products among all rural and most urban subjects. Majority of the rural subjects also reported inadequate cereal (carbohydrate) intake (84.3%), pulses/legumes (protein) intake (71.8%) & fats/ oils (68.7%). More than half of the subjects reported inadequate fruit (59.3%) and vegetable (53.1%) intake. These results are being used in conjunction with total calorie requirements and measurements of body mass index to develop an integrated index of nutritional status. Conclusion: FFQs allow more precise assessments of nutritional status while also providing insights into specific nutritional deficiencies. Inclusion of this information for the SICAPHE subjects would allow an examination of the contributions of nutrition as both a direct determinant of low birth weight and as an effect modifier in the relationship between air pollution exposures and birth weight.

Abstract Number	**P-3-15-05**
Presenter	Maria Christine Magnus*, Wenche Nystad, Per Nafstad, Lisa DeRoo, Per Magnus, Siri Eldevik Håberg, Stephanie J. London
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Association Between Alcohol Exposure During Pregnancy and Breastfeeding With Early Childhood Respiratory Health

Background: Animal studies indicate that alcohol exposure during pregnancy and lactation may influence immune system and lung development, with potential consequence for asthma and respiratory tract infections. Data in humans are few. Aim: To examine the associations between maternal alcohol intake during pregnancy and breastfeeding with current asthma at 36 months and recurrent lower respiratory tract infections (LRTIs) by 36 months Methods: This study included 49,138 children in the Norwegian Mother and Child Cohort Study. Maternal alcohol intake and early childhood respiratory disorders were classified by questionnaires. Information was obtained on frequency of alcohol intake and number of drinks per time for 1st, 2nd, and 3rd trimester, in addition to when the child was 0-3 months. Adjusted relative risks (RR) were estimated using Generalized Linear Models comparing women who reported alcohol intake to those reporting none. Results: Alcohol intake was reported by 31.8% of mothers in the 1st trimester, 9.7% of mothers in the 2nd trimester and 15.6% in the 3rd trimester. There was no increased risk of asthma in the child related to maternal alcohol intake during pregnancy – RRs were slightly below one for all metrics of intake. For LRTIs RRs were all close to one, with a few RRs slightly above one but without evidence of dose response. Among children exclusively breastfed, we examined maternal alcohol intake when the child was 0-3 months, and found no association with asthma or LRTIs. Conclusion: There was no consistent finding that modest alcohol intake during pregnancy or breastfeeding was positively associated with asthma or LRTIs. The inverse association between the low alcohol intake during pregnancy in our population and asthma is likely non-causal.

Abstract Number	**P-3-15-06**
Presenter	Nathalie Wesolek*, Alain-Claude Roudot
Exposure	food
Health domains	cancer
Type of research	others

Bayesian regression of shelling stock pistachio prevalence in link with aflatoxin contamination and climate

Aflatoxin contamination in pistachios is a threat for human health due to the fact that these mycotoxins, produced by Aspergillus fungi, have genotoxic carcinogenic effects, with no threshold. Climate and geographic conditions are very important determinants of the prevalence and distribution of Aspergillus species. Aflatoxin contamination level and incidence rate in pistachios is related to climate, as the contaminated pistachios are mainly found among the ones with a ruptured hull. When the hull ruptures in the orchard, the kernel is exposed to invasion by Aspergillus fungi and insects that are contamination vectors. More precisely, the hull rupture incidence is possibly in link with temperature and/or rainfall during a specific period. The aim of this work was to assess this link thanks to Bayesian simulations. The Bayesian method was used for regression analysis, as it improves classical estimators in terms of the precision of estimates. The hull rupture incidence under study results in lower value pistachios after processing, as they consist of dark stained and shell damaged nuts, categorized into shelling stock pistachios. The shelling stock data used were the ones from US Pistachio production yearly statistics by county from 2005 to 2012. The prior distributions of the parameters were calculated for years 2005 to 2010 and were combined to the likelihood equation. The result was a posterior estimate of the parameters, using data from 2011 and 2012. Posterior estimates were obtained for counties having a steppe climate: Kern, Fresno, Kings and Madera. These preliminary results show that the Bayesian method improves the estimation of model parameters in comparison to classical statistical analysis. The method is going to be extended to other counties in order to determine the link between climate and shelling stock pistachios.

Abstract Number	**P-3-15-07**
Presenter	Christina Porucznik*, Eric Brozek, Kyley Joell Cox, Lindsey Canfield Schmidt, Joseph Stanford, Diana Wilkins, James VanDerslice
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

Comparison of Single-Day BPA Exposure Estimates to Those Determined by Multiple, Consecutive Daily Sampling in a Prospective Cohort

Background: Bisphenol A (BPA) is a common endocrine disrupting chemical to which daily exposure can vary widely based on contact with canned food, polycarbonate-bottled liquids, and other consumer products. Objective: To quantify the difference between a geometric mean of several BPA measurements and a single BPA measurement for individual participants with the goal of estimating error in exposure assessment when only a single sample is available. Methods: A prospective, pre-conception cohort of couples without known infertility was recruited in Utah beginning in early 2012. Recruitment is ongoing. Couples observed cervical mucus to identify an estimated day of ovulation (EDO) and fertile window. Participants collected first-morning urine samples beginning during the fertile window, after which men discontinued collecting but women collected for the remainder of the cycle. Geometric means with 95% confidence intervals (CI) for BPA concentrations were calculated by taking the antilog of the mean of the natural log-transformed values. We compared the BPA concentrations measured for each participant on a single day of observation (EDO+2) to the geometric mean concentration for that collection cycle. Results are presented for the first 85 cycles collected by both male and female participants. Results: Cycle-level geometric means ranged from 0.2 ng/mL to 13.2 ng/mL and single-day BPA values ranged from 0.75 ng/mL to 118.0 ng/mL. When comparing discrete EDO+2 values to the geometric means within individuals, the differences ranged from 0.96 ng/mL to 29.82 ng/mL. These differences represent a mean 2.5 fold change from EDO+2 to geometric means with range from 1.01 fold to 21.0 fold. Direction of change was inconsistent, with 48 (56%) of cycles in which the single-day measure was higher than the cycle-level mean. Conclusions: Urinary BPA measurements vary dramatically both between and within individuals over time. Reliance on a single BPA measurement may introduce bias into the exposure classification.

Abstract Number	**P-3-15-08**
Presenter	Monika Filipsson*, Anna Augustsson, Sofia Nyholm
Exposure	metals
Health domains	no health domain
Type of research	others

Consumption of vegetables and risk perception at contaminated glass works sites in Sweden

Background Glass has been produced since the 18th century in Kalmar and Kronoberg counties in an area called the Kingdom of Crystal. The production of glass has been associated with high levels of heavy metals in the soil. The most critical exposure pathways for metals are oral intake of soil, consumption of water and home-produced vegetables. The consumption of home-produced vegetables in particular is a highly site-specific exposure pathway and is therefore of interest to investigate in this geographic area. Aims The study aims to investigate to what extent home-produced vegetables are consumed by people living near glass work industries as well as their perception of environmental and health risks and the authorities' risk communication. Methods A questionnaire including questions about personal factors, consumption of vegetables and fruit as well as the perception of risks and risk communication was sent to 300 randomly selected individuals living in areas close to glass works. Results A majority of those questioned, 87%, consume vegetables or fruit from their own garden sometime during the year and more than half of the respondents eat these food items on a regular basis or several times a year. Just over 40% are concerned about that the fruit or vegetables from their own garden may be contaminated with pollutants from the glass works, but an even greater number are concerned that pollution from glass works will affect their health or the environment in general. More than half of the respondents would like to have more information about environmental and health risks. Conclusions Home-produced vegetables are frequently consumed in areas around glass work industries. Many residents are at the same time concerned and request more information about possible risks. Site-specific studies including quantities and types of vegetables ingested as well as contamination levels are needed to investigate if the exposure is actually of concern.

Abstract Number	**P-3-15-09**
Presenter	Jung-Wei Chang*, Chung-Yu Chen, Bo-Ruei Yan, Mei-Hua Chang, Su-Hsiang Tseng, Ching-Chang Lee
Exposure	food
Health domains	reproductive outcomes
Type of research	health impact assessment

Cumulative risk assessment for plasticizer-contaminated food using the hazard index approach

Background Phthalates have been demonstrated considerable adverse effects on reproduction, development, and liver function. In May 2011, a severe plasticizer-contaminated food episode occurred in Taiwan because of improper use one of plasticizer- DEHP to replace palm oil in food and drinks as a cloudy agent. Aim To conduct a cumulative risk assessment for simultaneous exposure to nine phthalates in contaminated food items using the hazard index. Methods The HPLC-ESI-MS/MS was used for determination of nine phthalates in 1200 foodstuff samples. We estimated the average daily dose (ADD) of phthalates based on the ingestion rate of foodstuffs by a sex and age-specified population database derived from the Nutrition and Health Survey in Taiwan survey. In cumulative risk assessment, estimated ADDs were divided by TDIs to produce Hazard Quotients (HQs), which would be added to produce the Hazard Index (HI). The distributions of ADD and HI values were analyzed by Monte Carlo simulation to obtain probabilistic parameters. Results In all 1200 samples, DEHP was present at the highest level among all phthalates, with a mean level of 0.443 mg/kg,followed by DiNP (0.154), DiBP (0.089), DnBP (0.083), DiDP (0.05), DMP (0.031), DnOP (0.029), BBzP (0.027), and DEP (0.026). Although the highest ADD was found in DEHP, ΣDBP(i+n) posed the highest risk potential of all the phthalates. In seven phthalates, the 99th percentile HQs for ΣDBP(i+n) in almost all the population were greater than 1, except for the women (13–16 and 19– 64 years) and the elderly (> 65). Regarding to the anti-androgenic effects of phthalate, the 99th percentile HIs in almost all the population were greater than 1, except for the elderly (> 65). For the adverse hepatic effects, the 99th percentile HIs in almost all the population were greater than 1, except for the elderly women. Conclusion These results show that it is probably that Taiwan general population are suffering adverse health effects from current contaminated foods exposure to these phthalates.

Abstract Number	**P-3-15-10**
Presenter	Gea Oliveri Conti*, Chiara Copat, Cristina Mauceri, Maria Fiore, Alfina Grasso, Maria Grazia D' Agati, Roberto Fallico, Margherita Ferrante
Exposure	food
Health domains	cancer
Type of research	exposure measurement

Detection of antibiotics in feed and farmed fish

Background The consumption of fish products bring significant health benefits, therefore the demand for fish is greatly increased and this request is satisfied by farmed fish. Several studies have reported the presence of pharmacological residues as antibiotics in farmed fish with potential hazardous to the consumer. Use of Crystal Violet (CRI), Gentamicin (GE), Fluoroquinolones (FUQ), Chloramphenicol (CLO), Malachite Green (MG), Furaltadone (FU) and Furazolidone (FZ) is banned by Reg. CE 37/2010 for the severe effects on consumers. Aims The aim of our study was to evaluate the presence of antibiotics banned in the EU in fish muscle and in feed used for their feeding. Methods The sample extraction was carried out by specific ELISA Kits-BioScientific. Detection of antibiotics was carried out by use of a microplates reader Thermo scientific. Results All antibiotics tested were identified in feeds.The mean concentration of ∑antibiotics, is 40.44 ppb. In feed prevails use of GE, CRI and CLO (respectively with average of 31.84; 4.05 and 3.67 ppb).The fish tissues showed a positivity to all drugs investigated with a mean concentration of CLO, CRI, VM, FU and FZ respectively of 0.57; 2.05; 0.45; 0.29 and 0.09 ppb. With a mean ∑ of 3.45ppb. Conclusion Our data showed that feeds used for fish feeding are contaminated by antibiotics banned and this contamination is detected in the muscle of farmed fish. In fact the 50% of farmed fish are used in the production of fish meal, primary component of the feed, hence occurs the bioaccumulation of drugs in the muscle of farmed fish.The consumption of farmed fish therefore may represent a risk to consumers that must be managed by strengthening of targeted checks for the fish- feed quality.

Abstract Number	**P-3-15-11**
Presenter	Eleni Papadopoulou*, Ida Henriette Caspersen, Helen Engelstad Kvalem, Helle K Knutsen, Talita Duarte Salles, Jan Alexander, Helle Margrete Meltzer, Manolis Kogevinas, Anne Lise Brantsæter, Margaretha Haugen
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

Dietary intake of dioxins and polychlorinated biphenyls and birth outcomes in the Norwegian Mother and Child Cohort Study (MoBa)

Background: Maternal diet provides essential nutrients to the developing fetus but is also a source of prenatal exposure to environmental contaminants. Aim: We investigated the association between dietary intake of dioxins and PCBs during pregnancy and birth outcomes. Methods: This study included 50,651 women from the Norwegian Mother and Child Cohort Study (MoBa). Dietary information was collected by FFQs and intake estimates were calculated by combining food consumption and food concentration of dioxins, dioxin-like PCBs and non-dioxin-like PCBs. We used multivariable regression models to estimate the association between dietary intake of dioxins and PCBs with anthropometric measurements at birth and fetal growth. Seafood is the main dietary source of dioxins and PCBs and is linked to beneficial effects on fetal growth. We conducted further stratified analysis by quartiles of seafood intake during pregnancy. Results: We found an inverse dose-response association between dietary intake of dioxins and PCBs with birth weight, length and head circumference, after adjustment for confounders. Newborns of mothers in the upper quartile of dioxin and dioxin-like PCBs intake had 62 g lower birth weight (95%CI: -73 to -50), 0.26 cm shorter birth length (95%CI: -0.31 to -0.20) and 0.10 cm shorter birth head circumference (95%CI: -0.14 to -0.06) compared to the lower quartile of intake. The negative effect of dietary dioxins and dioxin-like PCBs intake persisted through quartiles of seafood intake, though for high seafood intakes we observed a smaller negative effect. Similar results were found for non-dioxin-like PCBs intake. Conclusions: Prenatal dietary exposure to dioxins and PCBs is associated with reduced fetal growth in a low exposed population of pregnant women. We provide evidence that the beneficial effects of maternal seafood consumption on fetal development might be compromised due to the adverse effects of contaminant exposure.

Abstract Number	**P-3-15-12**
Presenter	Budi Haryanto*
Exposure	ambient air pollution
Health domains	neurobehavioral effects
Type of research	randomized trial

Effect of Calcium Supplementation on School Children's Blood Lead Levels in Indonesia

Population exposures to lead are mainly related to: vehicle exhaust, in areas where leaded-gasoline is still being used; paint and lead solder in canned food; drinking water pipes; and from certain culturally-based exposures, such as use of lead-glazed ceramics or ayurvedic medication. It is well documented that excess exposure to lead causes health problems in children including neurobehavioral deficits. The objective of this study was to examine the effect of daily calcium supplementation for a three months period on reducing blood lead levels (BLLs) among elementary school children aged 9 to 11 years old in Bandung, Indonesia. Forty elementary schools were randomly selected, 400 children enrolled, and a total of 298 children completed follow-up of 3 months periode. Schools were divided randomly into two groups of calcium-supplement intervention groups (250 mg and 500 mg) and one control group with no intervention. Capillary blood samples were analyzed for lead levels before and after three months of calcium supplementation. The percent reduction in BLLs for each group was: 15.1% (no calcium) from the baseline of 13.7 mg/dL; 49.8% (250 mg Ca) from the baseline of 14.8 mg/dL; and 74.5% (500 mg Ca) from the baseline of 14.1 mg/dL. This study found statistically significant inverse associations with dietary Ca supplementation and BLLs in young children. These findings suggest that calcium supplementation effectively lowers BLLs in school children.

Abstract Number	**P-3-15-13**
Presenter	Chu-Chih Chen*, Yin-Han Wang, Chao Hsiung
Exposure	food
Health domains	other
Type of research	health impact assessment

Exposure assessment and the associated adverse health effects of possibly highly exposed Taiwanese children to phthalates through dietary intakes

Backgroun: Phthalates (DEHP), a chemical as plastic softener, was accidentally found to have been illegally used as clouding agent in numerous food products for more than a decade in 2011 in Taiwan. Aims: To assess the extent of exposure and the associated adverse health effects of the study children. Methods: A food frequency questionnaire (FFQ) was designed to assess the extent of exposure through dietary intakes of contaminated drinks, jams, nutritional supplements in the forms of tablets and capsules. Biomarkers of sexual hormone, thyroid, liver, kidney functioning, allergy, and insulin like growth hormone factors (IGF) were measured from blood samples collected during clinical visit. One hundred and ninety children ages under 12 who were potentially highly exposed to nutritional supplements contaminated with phthalates were assessed for their extent of exposures and the associated adverse health effects in this study. A lognormal distribution for variation of DEHP concentration in each supplement product item was fitted . This quantity was then multiplied with the intake frequency and period and summed up across different food categories for further uncertainties in exposure using a multi-level model to assess the daily intakes of DEHP for each individual based on their FFQ scores. A regression model to link the measured biomarkers with the assessed DEHP exposure was then applied with regression coefficients estimated using Markov chain Monte Carlo simulations to identify the associations between phthalates exposures and adverse health effects. Results: Among the markers, free-T4, IGF-1, and GOT were significantly associated with the assessed DEHP exposures of the studied children adjusting for age and gender.

Abstract Number	**P-3-15-14**
Presenter	Jeffrey Ashley*, Jaleesia Amos, Derek Desanto, Colin Fennelly, Anthony Rodriguez, Allison Zappulla, Jacob Shusterman, Paul Kiry
Exposure	food
Health domains	other
Type of research	health impact assessment

Fortifying children's diets with fish oils: Are health benefits off-set by contamination?

Previous studies have highlighted the potential beneficial health effect of polyunsaturated fatty acids (PUFAs) in young children. Recognizing that natural PUFA sources may be limited in the diets of children, dietary supplements and foods fortified with fish-oil have become popular. However, the potential benefits of increasing PUFA intake may be offset by the presence of contaminants such as PCBs and mercury. To assess potential contaminant exposure to children, we analyzed various dietary supplements and food products fortified with fish oils. For example, all children's dietary supplements studied contained PCBs and, following serving size suggestions, would provide mean daily exposure values ranging from 2.5 to 50.3 ng of PCBs/day. Conversely, for baby food fortified with tuna oil, mercury concentrations and calculated daily dietary exposures were very low, especially compared to exposures from ingesting fresh or frozen fish. Children who use fish oil supplementation and/or eat fish-oil fortified foods in addition to 'natural' sources of PUFAs (e.g., fresh or frozen fish) receive higher daily exposures than those who do not.

Abstract Number	**P-3-15-15**
Presenter	Emily Somers*, Martha Ganser, Wendy Marder, Lu Wang, Sung Kyun Park, Jeffrey Warren, Niladri Basu, Suzanna Zick
Exposure	food
Health domains	autoimmune disease
Type of research	cross-sectional study

Intake of polyunsaturated fatty acids and antinuclear antibodies in the general US population

Background: Antinuclear antibodies (ANA) are detected in >10% of the general US population, and can develop years in advance of a clinical autoimmune disease. Omega-3 (n-3) fatty acids are anti-inflammatory, and omega-6 (n-6) are pro-inflammatory, thus may be relevant to autoimmunity. Aims: To examine the cross-sectional association between dietary ratio of n-6/n-3 and antinuclear antibody (ANA) positivity among persons 12-85 years in the general US population (NHANES 1999-2004). Methods: Based on 24-hour dietary interview, n-3 was calculated as (octadecatrienoic + eicosapentaenoic + docosahexaenoic acids) and n-6 as (octadecadienoic + eicosatetraenoic acids). ANAs were measured by HEp-2 indirect immunofluorescence assay (positive ≥1:80). Statistical analyses accounted for survey sampling design. Multivariable logistic regression adjusted for covariates defined a priori (sex, age, race/ethnicity, education, body mass index, total caloric intake, survey cycle). The ratio of n-6/n-3 was examined as a piecewise continuous variable. Results: Among 4460 persons (mean age 43, 51% female), 13.7% were ANA+ and mean n-6/n-3 ratio was 10.7. N-6/n-3 ratio was significantly associated with increased risk of ANA positivity: for each unit increase in n-6/n-3 for ratios ≤7, the odds of being ANA+ increased 40% [adj OR 1.4 (95% CI 1.1, 1.7)] but plateaued for ratios >7 [adj OR 1.0 (95% CI 0.98, 1.02)]. Results were similar when restricted to adults (≥18) and in a sensitivity analysis further adjusting for total blood mercury (THg) among the subset of 1272 females 16-49 with THg data. Conclusions: In a representative population of 12-85 year olds in the US, the ratio of n-6/n-3 fatty acids is associated with ANA positivity. Longitudinal studies are needed to assess temporality of this association and the relationship to progression to clinical disease.

Abstract Number	**P-3-15-16**
Presenter	Jaymie Meliker*, Roxanne Karimi, Susan Silbernagel, Keith Levine
Exposure	food
Health domains	autoimmune disease
Type of research	cohort study

Mercury, omega-3 fatty acids, thyroid hormones, and thyroid antibodies in an adult cohort of avid seafood consumers

Background: Mercury accumulates in the thyroid gland and mechanistic evidence suggests selective binding to sulfhydryl (SH)-containing ligands in the thyroid, among other mechanisms of action. The few epidemiologic studies that have investigated associations between mercury and thyroid hormones and thyroid antibodies have produced mixed results, although recent studies using NHANES have suggested inverse associations with thyroid hormones and positive associations with thyroid antibodies. Aims: We investigated relationships between thyroid hormones (total and free thyroxine [TT4 and FT4], total and free triiodothyronine [TT3 and FT3], thyroid-stimulating hormone [TSH, continuously, and >4 mIU/ml]), thyroglobulin antibody positivity [TgAB>4IU/ml], and thyroid peroxidase antibody positivity [TPoAB>9 IU/ml] with ln-transformed blood Hg in a cohort of avid seafood consumers with elevated mercury exposure. Methods: Blood was collected from a 290 avid seafood consumers on Long Island, NY, USA, and analyzed for Hg at the RTI Trace Inorganics Laboratory, omega-3 fatty acids at the Guelph Lipid Analytics Laboratory, thyroid hormones and TPoAB by Arup Laboratories, and TgAB by USC Endocrine Laboratories. Using linear and logistic regression, we estimated Hg-thyroid marker associations after adjusting for age, sex, race, education, income, work status, and omega-3 fatty acids in blood; analyses were also stratified by sex and omega-3 fatty acid levels (median-cut). Results: Geometric mean blood Hg=4.42 µg/L, with a maximum=51.0 µg/L. There were 32 cases positive for TPoAB, 15 for TgAB, and 43 for TSH. No evidence of association was observed between mercury and thyroid hormones or thyroid antibodies in unadjusted, fully adjusted, or stratified regression analyses. Conclusions: In contrast to recent associations between low-level mercury and thyroid hormones and antibodies, we did not observe associations in this fish-easting population exhibiting higher mercury levels.

Abstract Number	**P-3-15-17**
Presenter	Cian O' Mahony*, E.J. Daly
Exposure	food
Health domains	other
Type of research	exposure modeling

Novel Databases and Models for Aggregate Exposure Assessment to Fragrance Materials (Oral Presentation)

Background: Accurately estimating consumer aggregate exposure to fragrance materials from use of cosmetics and personal care products requires information on habits and practices, along with fragrance use levels in products. This data is available from separate studies and was linked probabilistically using computational models. The use of such models avoids overly conservative deterministic methods permitting a more realistic measure of exposure to fragrance ingredients within the population. Aims: Develop a comprehensive dataset and model for estimating aggregate exposure to fragrance materials in cosmetics and consumer products. Methods: Habits and practices data for over 36,000 consumers in four EU countries and the U.S. was obtained and collated into a comprehensive database. This was created by linking market study data to distributions of amount of product use data obtained from studies conducted in Europe by Colipa (now Cosmetics Europe) and in the US by CTFA (now the Personal Care Products Council). The individual subject data was also linked demographically to distributions of body weights and skin surface areas per body part. Co-use and non-use of different products is built into the data, as well as the relevant biometric parameters per consumer. This was integrated with several novel probabilistic exposure models for fragrance materials. Results: A database and methods for accurately estimating consumer exposure to fragrance materials. Conclusions: Probabilistic modelling, together with concatenated data from appropriate sources can be used to accurately profile fragrance exposure, extensible to the majority of fragrances on the market. The established model provides an accurate estimation of consumer exposure per unit skin surface area (mcg/cm2) and per unit bodyweight (mg/kg) to fragrance materials and allows exposure calculations such as distributions of individual product exposure, total product exposure, as well as exposure per body part.

Abstract Number	**P-3-15-18**
Presenter	Motti Haimi*, Aaron Lerner
Exposure	food
Health domains	other
Type of research	review

NUTRITIONAL DEFICIENCIES IN THE PEDIATRIC AGE GROUP IN A MULTI-CULTURAL DEVELOPED COUNTRY- ISRAEL

Background& aims: Nutrient deficiencies are prevalent worldwide, especially in children from low income areas. Many diseases and morbid conditions have been described to result from nutritional deficiencies. The most common nutrient deficiencies among school kids are: calcium, fiber, folate, iron, magnesium, potassium vitamin D and vitamin E. Classical nutrient deficiencies lead to stunting, rickets and other bone abnormalities, iron deficiency anemia, and goiter. It is essential to address nutrient and activity deficiencies as these may lead to chronic long-term health problems such as obesity, coronary heart disease, type 2 diabetes, stroke, cancer and osteoporosis. Methods: In this review we surveyed the extent andseverity of nutritional deficiencies worldwide and especially in Israel, through a very comprehensive review of previous reports and research studies done during the last years in Israel and worldwide. Results: Israel populations have multiple nutritional deficiencies including iron, calcium, zinc, folic acid, and vitamins B12, C, D and E, spanning all age groups, several minorities, and specific regions. In Israel, some of the nutrients are mandatory implemented and many are on voluntary industrial initiative basis. Conclusions: We suggest ways to prevent and treat the nutritional deficiencies, as a step to forward food fortification in Israel.

Abstract Number	**P-3-15-19**
Presenter	Joan Casey*, Brian Schwartz, Frank Curriero
Exposure	food
Health domains	infectious diseases
Type of research	case-control study

Residential proximity to high-density livestock farms or manure-applied cropfields and risk of tetracycline-resistant S. aureus infection, Pennsylvania, USA

Background: Contact with livestock has been identified as a risk factor for colonization with methicillin-resistant Staphylococcus aureus (MRSA). However, an expanding literature suggests that livestock-associated S. aureus is additionally likely to be resistant to tetracycline, as tetracycline is commonly added to animal feeds. Tetracycline-resistant S. aureus (TRSA) is also commonly found on US retail meat. No population-based studies have assessed the association of proximity to high-density livestock production with TRSA infection.Aims: To evaluate associations of proximity to high-density livestock farms or crop field manure application and risk of TRSA infection in a case-control studyMethods: 295 incident TRSA infections were identified using culture data from over 400,000 primary care patients of the Geisinger Clinic in Pennsylvania from 2001 to 2010. A nested case-control study was conducted using the Clinic's electronic health record. Farms (n = 326) and crop fields (n = 424) were geocoded using Department of Environmental Protection nutrient management plans, which provided data on farm location, number and type of animal, manure production, and season and destination of exported manure. Spatial analysis and multilevel logistic regression will be used to assess associations between residential proximity to farms and manure-applied crop fields and risk of TRSA infection, adjusting for potential confounding variables.Results: From 2004-09, TRSA cases increased by 20% (SD = 12%) annually, while outpatient visits, a surrogate for person-years of observation, increased by 4% per year. Most cases (97%) were community-onset. The median age (range) at diagnosis was 45.9 years (9.3-95.9) and 52% were female. Adjusted analyses comparing quartiles of exposure of cases and controls will be presented.Conclusions: The study will provide the first data on proximity to high-density livestock operations as risk factors for TRSA infection. These data can be used to inform future policy decisions regarding the use of antibiotics in animal feed.

Abstract Number	**P-3-15-20**
Presenter	Colin Soskolne*
Exposure	food
Health domains	policy
Type of research	others

Responsibilities of Epidemiologists in the Conduct and Dissemination of Research in the Public Interest

Background: When suggestions of harm to human health are presented through animal or anecdotal evidence, epidemiologists rally to establish if the effects carry over to human populations. Their goal is to prevent continuing harms at the population level. And, so it was with a study of aspartame in relation to certain cancers. Aim: To bring to attention the controversy initiated in the Boston USA area on October 24, 2012, when epidemiologists, fulfilling their role in protecting public health, had their research undermined by their employing university/affiliated hospital. Method: Media releases form the basis of this analysis. Results: With access to an existing prospective cohort with dietary information, researchers at Channing Laboratory, affiliated with Brigham and Woman's Hospital (BWH) and Harvard Medical School, Boston, USA, pursued the connection between aspartame consumption and the development of certain cancers. This research was motivated by the finding of such an association in animal models out of Italy a few years prior. With a positive finding in men only, not only did they experience difficulty finding a home for their article, but, when it was eventually accepted and about to be published on-line, BWH used its public relations office to cast doubt on the study. This action has resulted in controversy for the researchers, the affiliated institutions, and a confused and frustrated public. Conclusions: This experience provides a case study in professional and scientific integrity, having ethical, moral, and public health implications. It raises several questions, including whether the aspartame industry wielded any influence in blocking the work from being published, and any role that a university can play in vetting research prior to publication in terms of an academic's autonomy. Ten questions are raised and deserve to be discussed among all scientists, especially applied scientists, internationally, if the integrity of the scientific enterprise, academic freedom, and the public interest are to be protected.

Abstract Number	**P-3-15-21**
Presenter	Osaretin Alexander Giegbefumwen*, Ikwe Ajogi, Emmanuel Okolocha
Exposure	food
Health domains	parasitic disease
Type of research	cross-sectional study

SERO-PREVALENCE OF TOXOPLASMA GONDII ANTIBODIES IN PIGS AT SLAUGHTER IN KAFANCHAN AND KADUNA TOWNS, KADUNA STATE, NIGERIA

Toxoplasma gondii is the cause of toxoplasma infection in food animals and humans the world over. The infection results in stillbirths, abortion and barrenness in animals and in man. The study was carried out to determine the seroprevalence of T. gondii infection in slaughtered and farm pigs in Kafanchan and Kaduna towns, Kaduna State, Nigeria. Serum samples were collected in pig slaughterhouses in Kafanchan (200) and Kaduna (102). Information on sex and age were obtained from each location. Toxoplasmosis Indirect multi-species Enzyme-Linked Immunosorbent Assay commercial kit obtained from ID-Vet, Montpelier, France were used to detect T. gondii specific IgG antibodies. The findings showed a seroprevalence of 16.6% T. gondii in pigs at slaughter. the slaughterhouse- based seroprevalence was 51.4%, 10% and 3.75% respectively. There was a statistically significant difference ($p<0.05$) between the seroprevalence for male (9.0%) and female (20.8%) pigs in slaughterhouses. However, there was statistically significant difference ($p<0.05$) in both sexes. This study has demonstrated the presence of T. gondii antibodies in pigs slaughtered in Kafanchan, Kaduna metropolis. Slaughterhouse workers, Veterinarians, pig handlers and pig consumers are at the risk of Toxoplasma gondii infection in the study area. Intensified public awareness campaign on T. gondii in pig farming and consuming public is indicated.

Abstract Number	**P-3-15-22**
Presenter	Michael Laxy*, Kristen C. Malecki, Marjory L. Givens, F. Javier Nieto
Exposure	food
Health domains	obesity
Type of research	cross-sectional study

The association between the retail food environment, economic deprivation, fast food intake and obesity: Findings from the Survey of the Health of Wisconsin

Background: The Retail Food Environment (RFE) has been identified as key factor of the obesogenic environment. The access to certain types of food retailers is assumed to determine individuals' dietary behavior and weight status. Aims: This work aims to investigate the relationships between the RFE, socioeconomic deprivation, dietary habits, and obesity prevalence. Methods: Data was obtained from the population-based Survey of the Health of Wisconsin of 1570 residents aged 21 to 74 years and from an ESRI retailer database. Using ArcGIS network analyst the mean distance from the individuals' homes to the three closest a) supermarkets, b) convenience stores and c) fast food restaurants was calculated. Further, the Wisconsin Retail Food Environment Index (WRFEI), defined by the ratio of the mean distance to the three closest supermarkets to the mean distance of the three closest fast food restaurants/convenience stores was assessed. Regression models were adjusted for sex, age, education, income, race, physical activity and stratified for urbanicity-level . Results: Residents living in more deprived neighborhoods faced a less favorable Retail Food Environment (WRFEI=1.77) than residents from the least deprived neighborhoods (WRFEI=2.53; $p<0.001$). Participants with low (OR=0.62; CI: 0.38-0.99) or average access (OR=0.59; CI: 0.32-1.08) to fast food restaurants were less likely to have regular fast food consumption (≥2 times/week) compared to peers with high access. Urban residents with average (OR=2.10; CI: 1.15-3.90) or low access (OR= 3.24; CI: 1.73-6.08) to convenience stores were more likely to be obese than individuals with high access. Further, regular fast food intake was associated with a higher risk for being obese (OR=1.39; CI: 1.02-1.89). Conclusion: The retail food environment is crucially codetermined by socioeconomic deprivation. Proximity to fast food restaurants is associated with dietary habits but not with the weight status. More in-depth research is needed to examine the complex relationship between the food environment and humans' health.

Abstract Number	**P-3-15-23**
Presenter	Christina Porucznik*, Kyley Joell Cox, Lindsey Canfield Schmidt, James VanDerslice, Joseph Stanford, Diana Wilkins, Eric Brozek
Exposure	food
Health domains	reproductive outcomes
Type of research	cohort study

Urinary Bisphenol A Concentrations Measured on Multiple Consecutive Days in a Prospective, Pre-conception Cohort

Background: Bisphenol A (BPA) is an endocrine disrupting chemical found in canned food and other consumer products. BPA has been detected in human specimens throughout the world and at levels similar to those associated with adverse reproductive outcomes in animal models. Objective: To examine and compare the distribution of urinary BPA concentrations collected from partners of a male-female couple. Methods: A prospective, pre-conception cohort of couples (women 18–35, men 18–40) without known infertility were recruited in Utah beginning in early 2012. Recruitment is ongoing. Couples observed cervical mucus to identify an estimated day of ovulation (EDO) and fertile window. Participants collected first-morning urine samples beginning during the fertile window, after which men discontinued collecting but women collected for the remainder of the cycle. BPA was measured in each urine sample using quantitative liquid chromatography-tandem-mass spectrometry. Geometric means with 95% confidence intervals (CI) for BPA concentrations were calculated by taking the antilog of the mean of the natural log-transformed values. Differences in geometric mean by sex were tested using the Wilcoxon Test to account for daily repeated urines and the coupled, matched-pair design. Results: BPA was detected in 100% of samples at concentrations ≥0.4ng/mL. Within-individual values varied several-fold from day-to-day. Preliminary results of 846 urine samples (636 female, 210 male) show a geometric mean of BPA as 2.72ng/mL (95% CI, 2.57–2.88) and median of 2.63ng/mL (interquartile range, 1.78ng/mL). Geometric mean BPA levels were higher among men (p=0.025) at 3.26ng/mL (95% CI, 2.90–3.65) compared to women at 2.57ng/mL (95% CI, 2.41–2.74). Conclusions: These preliminary findings suggest that BPA exposure is higher among men than women. The high daily variability suggests that single-day measurement is likely insufficient for exposure assessment.

Abstract Number	**P-3-15-24**
Presenter	Maria Fiore, Gea Oliveri Conti, Caterina Ledda*, Giorgio Gerratana, Cristina Mauceri, Antonio Maieli Diaz, Roberto Fallico, Giovanni Battista Modonutti, Margherita Ferrante
Exposure	food
Health domains	obesity
Type of research	cross-sectional study

Urinary bisphenol A levels and increasing body mass: results of a cross-sectional study

Background According to the WHO, over 700 million obese people there are in the world and about 2 billion people are overweight. BPA has been shown to have endocrine-disrupting effects like behavioral changes, altered growth, and early secondary sexual maturation. In particular, there is evidence that epigenetic changes associated with the use of manmade chemicals may interact with other factors that influence fetal and postnatal growth in contributing to the current obesity epidemic. Epidemiological data in humans are still lacking. Aims A possible association between the urinary BPA levels and body mass index (BMI) of general adult population of the south Italy was investigate. Methods Occupation, education, and lifestyle habits, such as tobacco smoking, alcohol consumption, and other common demographic data were collected by a specific questionnaire. Overweight was defined as BMI from 25 to less than 29.9 kg/m2 and obesity was defined as BMI ≥30 kg/m2. Pooled 24 h urine samples were collected in polyethylene con-tainers and stored at –20°C until the analysis. BPA was determined by HPLC/MS. Results Participants were adults (61% females) non occupational exposed to BPA with the mean age of 50±13.6 years. 5.6% of the subjects were underweight, 33.3% were normal weight, 55.6% were overweight and 5.6% were obese. Average levels of urinary BPA show a trend from underweight to overweight subjects. The same trend is highlighted both for males and females group. A trend is not highlighted for obese group probably because of the small sample size. Conclusions Our results confirm the link between BPA exposure and the increased body mass as well as a widespread BPA exposure which might be an important risk factor for body weigh increase. Therefore, is recommended the counseling of patients by health professionals to decrease levels of exposure to endocrine disruptors particularly during important periods of development such as pregnancy, infancy and puberty.

Abstract Number	**P-3-16-01**
Presenter	Maria F. Cely-Garcia*, Juan P. Ramos-Bonilla, Camilo Herran, Angela Nieto, Nathalia Rincon, Juan D. Roldan, Jonathan Romero, Ficelle Takehara, Marcela Zambrano, Olga L. Sarmiento
Exposure	others
Health domains	respiratory disease
Type of research	occupational study

A METHODOLOGY TO ESTIMATE CURRENT AND HISTORICAL EXPOSURES TO ASBESTOS FIBERS AMONG BRAKE MECHANICS USING SECONDARY INFORMATION

Background: Colombian brake mechanics perform manipulation activities of Asbestos Containing Brake Products (ACBP), which release asbestos fibers exposing workers. Sampling campaigns are the most accurate method to determine exposure, but are expensive and time consuming. This study applies a different methodological approach to estimate current asbestos exposures among brake mechanics in large metropolitan areas, which can also be used for the reconstruction of their historical exposures. Aims: Identify both Bake Repair Shops (BRS) and brake mechanics that manipulate ACBP in selected zones of Bogotá (Colombia), and estimate current and historical asbestos personal exposures. Methods: Two areas with a large number of BRS in Bogotá (Colombia) were selected, and BRS located in these areas were visited. Structured questionnaires based on the OSHA Medical Questionnaire were culturally adapted and used for data collection. Annual personal exposures to asbestos were estimated based on: 1- the activities reported by workers and 2- the range of PCM-Equivalent personal exposures to asbestos previously determined by our research team in studies conducted in this occupational group. Estimations were compared against an annual standard of 25f/cm3. Results: A total of 90 workers' occupational histories from 37 BRS were collected. Theoretical estimates of annual personal exposures to asbestos ranged from 1,2 to 297,4 f/cm3 per year. The percentage of workers exceeding annual exposures of 25 f/cm3 ranged from 59% (i.e., using the lower concentration of the exposure range) to 88% (i.e., using the higher concentration of the exposure range). Conclusions: Manipulation processes of ACBP are still common in most of the BRS visited, although the number of ACBP manipulated has declined over time. Estimates suggest that an important number of brake mechanics may have been exposed to asbestos concentrations above the annual standard.

Abstract Number	**P-3-16-02**
Presenter	Zhe Li*, Fue-sang Lien (Dr. Professor), Zhongchao Tan
Exposure	others
Health domains	equity
Type of research	exposure measurement

Airborne Particles In Industrial Facilities in Ontario

The information about indoor air quality (IAQ) inside industrial facilities is largely missing, even though it is highly possible that the conditions inside such facilities are worrisome. This paper picks some random samples of industrial facilities of various sizes in Ontario and measures the airborne particle concentrations and its compositions. The focus is on PM2.5. Some benchmark information was established as regards to the current state of airborne particle concentrations in various different industrial facilities. Airborne particle counters were used to measure the airborne particle concentrations, temperature was also measured. Spatial distribution of the particle concentration and temperature was measured in some facilities. A sampling system was used to collect airborne particles with PM2.5 cut size. The particle samples collected were used to determine the mass concentration, some samples were also sent out for metal scan or SEM imaging. The information gathered in this paper clearly shows that there is a need to improve the indoor air quality in industrial facilities. Depending on the specific nature of the facility, facility managers should implement technologies appropriate to address the airborne particle issue. Further studies are recommended to include more facilities.

Abstract Number	**P-3-16-03**
Presenter	Pavel Shur*, Nina Zaitseva, Natalia Lebedeva-Nesevrya, Dmitriy Shlyapnikov
Exposure	noise
Health domains	cardiovascular disease
Type of research	cross-sectional study

AN ASSESSMENT OF A COMBINED IMPACT OF OCCUPATIONAL NOISE AND ALCOHOL CONSUMPTION ON THE DEVELOPMENT OF HYPERTENSION IN EMPLOYEES OF OIL-PRODUCING COMPANIES

Background / Aims: Behavioral factors, in particular alcohol consumption, can exacerbate the harmful impact of work environment factors on human health. So the aim of the study was to assess the combined occupational impact of occupational noise and alcohol consumption on the development of arterial hypertension in employees of oil-producing companies. Methods: The study assessed the relationship between the influencing factors and the prevalence of hypertension in the groups of the personnel of oil producing companies, who were exposed to occupational noise at 81-91 dBA (n=109), and non-exposed employees (n=215). Alcohol consumption was evaluated by a survey using the original Eurobarometer questionnaire, which was utilized in previous studies (EU citizens' attitudes towards alcohol, 2006, 2009). The criterion of alcohol consumption was considered to be alcohol consumption in the past 12 months. Among the respondents, 77.2% consumed alcohol. In the European Union countries, this indicator was 76% (Special Eurobarometer, 331). Results: In operators and mechanics of pumping stations, hypertension was identified as a work-related disease (RR =1.65, CI=1.18-2.30, EF=39.30%). In the employees who consumed alcohol, we determined a true relationship between the combined impact of alcohol consumption and occupational noise and the incidence of the disease (RR=1.82, CI=1.19-2.78, EF=45.02%). However, the relationship between the incidence of hypertension and alcohol consumption in the employees who were not exposed to occupational noise was unreliable (RR=1.13, CI=0.22-5.85). The risk of hypertension, identified as a work-related disease for the studied occupational noise levels, in individuals, who are exposed to occupational noise and consume alcohol, has been found to increase significantly.

Abstract Number	**P-3-16-04**
Presenter	Holton Michael*, Kevin Long, Robert Adams, Steve Song
Exposure	organic compounds
Health domains	no health domain
Type of research	health impact assessment

Appropriate Use of “Occupational” Exposure Levels vs. “Risk-Based” Levels in Assessing Vapor Intrusion Exposures in Occupational Settings

In the United States, many governmental bodies enforcing environmental regulations utilize “risk-based” assessments focused on the most sensitive subpopulations when analyzing environmental exposures, including those associated with vapor intrusion. In occupational settings, exposures are regulated based on the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and further analyzed based on other consensus standards such as the American Conference of Governmental Industrial Hygienist Threshold Limit Values (TLVs). These occupational exposure levels are generally based on the assumed exposure of adult workers. When vapor intrusion from subsurface contamination may represent a potential exposure at an occupational location, the decision to utilize “risk-based” or “occupational-based” levels can be complicated and confusing. These complications can be further compounded at sites where the chemicals related to vapor intrusion may be used in the manufacturing process and differentiating the portion of exposure associated with the industrial process from the portion associated with vapor intrusion can be important depending on the question being asked (e.g., is this safe work environment) or the decision which may need to be made (e.g., is remediation or exposure control warranted). This presentation will evaluate the underlying assumptions in the development of these exposure levels and provide attendees with the knowledge to determine appropriate exposure levels to use to support decision making for specific sites. We will demonstrate that the use of exposure levels which have been developed specific to the population at risk will result in more efficient and defensible decision making, which is particularly important in a resource limited world.

Abstract Number	**P-3-16-05**
Presenter	Sangjun Choi*, Sung-ea Park, Sugyeong Gwak
Exposure	organic compounds
Health domains	respiratory disease
Type of research	occupational study

Assessment of occupational symptoms and exposure to chemicals in nail salon technicians in Korea

Background : Professional nail care business in Korea was first introduced in the late 1990s and began rapidly booming recently. Purpose : The purpose of this study was to evaluate the occupational symptoms and exposure to chemicals in nail salon technicians. Methods : Work-related symptoms of nail salon technicians registered in Daegu Metropolitan City were surveyed using a researcher-administered questionnaire, and responses were compared to those of non-exposed office-based control subjects. Average work-shift concentrations of 14 chemicals were measured among 50 workers from 30 salons using personal passive samplers (OVM 3520, 3M). Results : A total of 159 subjects in 151 salons were interviewed. According to the results of the symptom survey, the nail shop workers reported statistically more complaints than the control group about headaches (OR=9.3, CI;4.7~18.2), dizziness (OR=3.6, CI;1.7~7.5), nose irritation (OR=54.0, CI;21.6~134.8), throat irritation (OR=4.3, CI;2.2~8.5), caugh (OR=5, CI;2.2~11.8), eye irritation (OR=13.1, CI;5.7~30.1), skin irritation (OR=5.2, CI;2.1~13) and musculoskeletal pain on the region of neck (OR=19.7, CI;8.9~43.6), shoulder (OR=20.3, CI;7.7~54), upper back (OR=12.5, CI;3.8~41), arm (OR=5.7, CI;2.3~14.4), wrist or hand (OR=5.3, CI;2.7~10.3). For personal measurements, acetone (787.3±622.2 ppm, >KOEL;64%), methyl methacrylate (47.6±135.0 ppm, >KOEL;12%), toluene (95.4±119.7 ppm, >KOEL;50%), and butyl acetate(166.8±188.1 ppm, >KOEL;46%) exceeded the occupational exposure limits of the Ministry of Employment and Labor in Korea. Conclusion : The findings of this study suggest that nail technicians report high levels of work-related respiratory symptoms and musculoskeletal problems compared to office-based controls. According to the results of personal measurements, the control of hazardous chemical ingredients in personal care product is warranted for the protection of health of nail salon workers and customers.

Abstract Number	**P-3-16-06**
Presenter	Thu Quach*, Julie Von Behren, Debbie Goldberg, Michael Layefsky, Peggy Reynolds
Exposure	others
Health domains	reproductive outcomes
Type of research	occupational study

Birth weight among the offsprings of Hair and Nail Care Workers

Background: In recent decades, beauty salons providing nail and hair care services have tripled in number across the U.S. Nail and hair care products contain multiple toxic and potentially hazardous ingredients, including chemicals that are linked to reproductive abnormalities in animal studies. Over 60% of nail salon workers in California are of Vietnamese descent. Aim: To determine whether women working in the hair and nail care service industry during or before pregnancy have a higher risk of delivering low birth weight babies. Methods: We conducted a statewide population-based retrospective cohort study of cosmetologists (providing hair and nail care services) and manicurists (providing nail care services) in California. Using probabilistic record-linkage we matched statewide cosmetology licensee and birth registry files to identify births for workforce members occurring between 1996 and 2009 (14-year study period). We compared birth weights among cosmetologists and manicurists to birth weights in the general population of women. Results: We linked 105,273 licensed cosmetologists to a live birth. The rate of low birth weight (<2,500 g) was 6.1% for the manicurists and 6.2% for the cosmetologists compared to 6.4% in the rest of the California births during this time (7.5 million births). The rate of very low birth weight (<1,500 g) was also similar across the three groups, with 0.9% in the manicurists, 1.1% in the cosmetologists and 1.0% in the general population. The rate of low birth weight among Vietnamese women was 6.0% for manicurists, 5.5% for cosmetologists and 6.4% in the general population. Conclusions: The rates of low birth weight among the cosmetologists and manicurists were similar to the rates in the general population.Future analyses are designed to examine additional birth outcomes such as fetal death and congenital anomalies, as well as assess potential risk relationships by length of licensure.

Abstract Number	**P-3-16-07**
Presenter	Yu-Jen Lin*, Wei-Te Wu, Chung-Yi Li, Chun-Yuh Yang, Saou-Hsing Liou, Trong-Neng Wu
Exposure	others
Health domains	cancer
Type of research	occupational study

Cancer incidence among former shipbreaking workers potentially exposed to asbestos - a 23-year follow-up study

Background: Shipbreaking, or ship demolition, involves breaking up of ships for scrap. Today most shipbreaking yards are in developing nations (principally Bangladesh, China, and India), due to lower labor costs and less stringent environmental regulations that deal with the disposal of lead paint and other toxic substances. However, workers from the shipbreaking industry are usually not tightly organized and tend to have a high turnover rate, rendering a high rate of loss to follow-up in cohort studies. Aim: The objective of this study examined whether there was an increase in risk of cancer among male shipbreaking workers over a 23-year follow-up period. Methods: Employment information on 4,962 shipbreaking workers (4,157 men and 805 women) were retrospectively collected from the Kaohsiung Shipbreaking Workers Union database set in 1985. The study cohort was then linked with Taiwan National Cancer Registry from 1985 to 2007 for incident cancer cases. Only those cases that developed cancer at least 10 years after first employment were counted in the analysis. The incidence ratios—standardized for age and calendar years-- (SIRs) for various sites of cancer associated with the study cohort were calculated as compared to the general population of Taiwan. Result: We noted an increased risk of oral cavity cancer (SIR=1.73, 95% CI: 1.33-2.21) in the study cohort. Additionally, the workers with an employment of more than 7 years experienced an increased risk of not only oral cavity cancer but also neoplasm of trachea, bronchus, and lung cancer (SIR=1.50, 95% CI: 1.01-2.14). Among various job titles, only flame cutters were associated with increased risk of developing lung cancer (SIR=1.54, 95% CI: 1.01-2.26). Conclusion: We found that the shipbreaking workers with a longer period of employment were at increased risks of neoplasm of trachea, bronchus, and lung cancer. Flame cutters were at the greatest risk among various job titles, and should be the object of further cancer preventive measures.

Abstract Number	**P-3-16-08**
Presenter	Jo S Stenehjem, Kristina Kjaerheim, Kjersti S Rabanal, Tom K Grimsrud*
Exposure	organic compounds
Health domains	cancer
Type of research	cohort study

Cancer incidence among 41 000 Norwegian offshore oil industry workers

Background: In 2012, the production of crude oil and natural gas on the Norwegian continental shelf involved over 50 national and international companies on 80 oil fields along the coastline. It has been a challenge to identify historically workers engaged in this scattered and complex activity, emerging since 1970. Cancer incidence in the workforce may be influenced by exposure to crude oil and petroleum components, combustion products, asbestos, silica, and metals. Additionally, platform workers have 12-hour shifts, abundant food, and long leave periods. Two cohorts have been established for cancer studies in offshore workers: one survey-based, and one from a governmental register of employers and employees. Aims: To investigate the degree of overlap between the cohorts, and to combine them in order to provide the most complete and extended follow-up of cancer incidence to date. Methods: Both cohorts counted nearly 27 000 workers, respectively, representing over 41 000 unique individuals. Incident cancers 1999–2009 were identified by linkage to the national Cancer Registry, and expected numbers were calculated from national age- and gender-specific rates. Standardised incidence ratios (SIRs) with 95% confidence intervals (CIs) were derived. Results: Each cohort shared approximately 50% of its members with the other one. The workers were young, on average turning 50 at the end of follow-up. Overall cancer risk was close to expected, with SIRs of 1.03 (95% CI 0.99–1.08) for men and 1.17 (95% CI 1.02–1.34) for women. The female excess mainly involved skin cancers. Comparison with the general population may underestimate the risks in this selected and active workforce. Some potentially occupational risks found in earlier studies were confirmed. Conclusions: The data indicated that both cohorts are fairly representative samples of Norwegian offshore workers. No large excess was found, but the cancer incidence pattern deserves further attention in studies with exposure data and confounder control.

Abstract Number	**P-3-16-09**
Presenter	Kathleen Clark*, Pallavi Balte, Lawrence Mohr, Wilfried Karmaus, Bo Cai, Dennis Ownby, Daniel Salerno, John Vena, Erik Svendsen
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Comparison of impulse oscillometry and pulmonary function testing following acute, severe chlorine gas exposure in millworkers seven years after the event

Background: Impulse oscillometry (IOS) is an emerging technique that requires less coordinated effort than spirometry. Hence, IOS may be a suitable screening tool along with spirometry to assess lung health in environmental and occupational epidemiology. We analyzed the 2012 Graniteville Recovery and Chlorine Epidemiology (GRACE) cohort data to determine millworker lung health following the 2005 accidental release of over 54,000 kg of chlorine in Graniteville, SC, USA. Aims: Compare differences in IOS between chlorine exposed and unexposed millworkers seven years after exposure. Evaluate IOS validity compared to pulmonary function testing (PFT). Methods: PFT and IOS were performed using ATS/ERS Guidelines. Lung volumes were determined via plethysmography. Millworkers were stratified into chlorine exposure groups. PFTs were based on lower limit of normal (LLN) estimates and classified into functional patterns for normal, obstructive, restrictive, or mixed disease from FEV1, FVC, FEV1/FVC ratio, TLC, RV, and ERV. IOS parameters analyzed were: resistance at 5 Hz (R5), resistance at 20 Hz (R20), frequency dependence (R5-R20), and reactance area (AX). General linear modeling (GLM) estimated the IOS differences between exposure groups. Sensitivity and specificity were determined for IOS compared to PFT. Results: Data were analyzed from 76 millworkers; 20 exposed (26.3%) and 56 unexposed(73.7%). Abnormal IOS was seen in 65% (n=13) of those exposed, whereas, 55% of PFTs (n=11) were abnormal. IOS sensitivity was moderately high (82%) and specificity low (42%). Mean R5-R20 difference was significantly higher in the chlorine exposed group (p=0.015). The IOS model adjusted for age and BMI (F=13.73, p<0.0001, R2=0.392). Conclusion: Findings suggest that the mean difference in R5-20 was significantly higher in millworkers exposed to chlorine. Increases in R5-R20 indicate peripheral or bronchiole sized airway abnormality/obstruction. In addition, IOS is a valid screening tool that tended to classify proportionately more abnormality than did PFT.

Abstract Number	**P-3-16-10**
Presenter	Juan P. Ramos-Bonilla*, Maria F. Cely-Garcia, Natalia Salazar
Exposure	others
Health domains	respiratory disease
Type of research	occupational study

COMPARISON OF PERSONAL EXPOSURES TO ASBESTOS FIBERS BETWEEN BRAKE AND TRANSMISSION MECHANICS DURING THE MANIPULATION PROCESSES OF ASBESTOS CONTAINING PRODUCTS

Background: In Colombia, asbestos containing brake and transmission products are still used in passenger and heavy-duty vehicles. Asbestos containing brake linings and clutch discs are sold detached from their supports, and because of this they require manipulation before installation. The manipulation processes for both types of products include drilling, countersinking, riveting, and grinding, activities that can release asbestos fibers. Aims: Compare short-term personal exposures of brake mechanics and transmission mechanics that result from the manipulation of asbestos containing brake linings and clutch discs. Methods: Five shops dedicated to the preparation of asbestos containing brake linings or clutch discs were sampled in this study. Short Term Personal Samples (i.e., 30 min) were collected in workers following NIOSH methods 7400 and 7402. Manipulation processes performed by each worker were recorded in activity diaries. Personal samples were collected in 7 brake mechanics (i.e., 42 short term samples) and 3 transmission mechanics (i.e., 36 short term samples). Asbestos counting was conducted by AIHA accredited US laboratories. A t-test was applied to determine if there was a significant difference in means between 30 minutes PCM fiber concentrations of the two occupational groups. Results: The mean PCM 30 min fiber concentration for brake mechanics was 0.129 f/cc and for transmission mechanics was 0.105 f/cc. The mean difference between the two occupational groups was not statistically significant (p=0.3107). Conclusions: Although the asbestos containing products (i.e., brake linings and clutch discs) differed between the two occupational groups, the manipulation activities performed on these products were similar. This could explain the similarity between groups in terms of short-term fiber exposures. Thus, the potential health risks for both types of workers could be similar. All the samples collected did not exceed the asbestos OSHA STEL.

Abstract Number	**P-3-16-11**
Presenter	Yu-Lieh Wu*, Ruei-Yan Lin, Hao Cheng
Exposure	no exposure
Health domains	healthrelated quality of life
Type of research	occupational study

Comparison of Requirements on Different Regulations for Fresh Air Volume and Analysis of Impact on Indoor CO2 Concentration Distribution

Abstract Poor indoor air quality influences people's physical and mental health, as well as work efficiency, especially in enclosed modern office buildings. Ventilating the rooms with fresh air is the precondition of good indoor air quality; however, excessive fresh air volume can result in excessive energy consumption. This study investigated office buildings, and selected the ventilation standards of four countries and regions. Using the minimum fresh air volume required in these four standards, this study examined the effects of occupant density on indoor environment quality. Full size space experiment was conducted to study the variation of pollutant concentration in breathing zone with indoor occupant density under the selected fresh air volume standards. The four standards selected in this study were the ASHRAE standard, China (GB50736-2012 standard), Labor Safety and Health Facility Rules of Taiwan (Taiwan standard), and Air Conditioning Manual of Japan (Japan standard). The occupant densities for this experiment included 0.19, 0.28, 0.37, 0.47 and 0.56 person/m2 respectively. The CO2 concentration in the breathing zone increased exponentially, and was stabilized at last. Based on the results, the conclusions are drawn as follows: For the same occupant density, when it is less than 0.47 person/m2, the American standard has the maximum CO2concentration in the breathing zone, followed by Japan standard and Taiwan standard, and GB50736-2012 standard has the minimum value; when the occupant density is greater than 0.47 person/m2, the American standard still has the maximum CO2 concentration in the breathing zone, followed by Japan standard and GB50736-2012 standard, and Taiwan standard has the minimum value. In order to control the CO2 concentration in the breathing zone below the limit of 1000ppm, the American standard, Japan standard and GB50736-2012 standard limit the occupant density, that shall be less than 0.19 person/m2, 0.19 person/m2 and 0.40 person/m2respectively, whereas Taiwan standard has not limited the occupant density.

Abstract Number	**P-3-16-12**
Presenter	María Guadalupe Gurrola*, Martha Georgina Orozco Medina, Mario Alfonso Murillo Tovar
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	occupational study

Contribution to the analysis of environmental conditions, health and labor in public works in a metropolis of western Mexico

BACKGROUND: Workers worldwide have basic benefits from the laws on health and safety at work. The International Labour Organization identifies that the legislation in developing countries omits various risk industries and occupations, such as agriculture, fisheries, forestry and construction. Workers in the construction industry and in particular the public construction workers are exposed to critical environmental and health conditions. OBJECTIVE. To analyze the environmental, health and labor conditions of the public construction workers in the Metropolitan Zone of Guadalajara. METHODS: Noise measurement, capture and gravimetry of PM10 particles during and after the construction on three public construction sites and application of questionnaires to workers. RESULTS: Sound pressure and PM10 particle levels that exceed the limits recommended by the World Health Organization and national regulations were registered. Regarding the applied surveys and direct observations, it was found that protective equipment is absent. CONCLUSION: It is necessary to implement formal studies to meet the environmental, safety and health characteristics, related to public construction and to propose normative regulations for protection.

Abstract Number	**P-3-16-13**
Presenter	Hien Le*, Kim Kreckmann, Sarah Starks, J. Morel Symons
Exposure	others
Health domains	physical activity
Type of research	occupational study

Environmental-Wide Association Study of Job Families Related to Musculoskeletal Disorders

Background: Musculoskeletal disorders (MSDs) are a leading cause of absenteeism that impact productivity. An environmental-wide association study (EWAS) is a computational approach to systematically evaluate multiple factors for potential associations with a specific outcome adapted from the genome-wide association study (GWAS) method. We examined job titles grouped by function for potential associations with MSD among U.S.-based workers of a global company. Methods: Eligibility and MSD status were determined from health insurance claims data from 2006 through 2011. Employees were categorized as ever having any MSD according to the presence of at least one claim for a list of conditions corresponding to ICD-9 codes. We fitted logistic regression models by calendar year with MSD as a dichotomous outcome to evaluate associations across 38 job families, defined as multiple job titles grouped by a similar function. Estimated odds ratios (OR) adjusting for age, sex, race, and pay type indicated the association between MSD claims and job families relative to no MSD claim during a calendar year. Results: Eligible workers (n=18,244) were predominantly white (81%) and male (73%). The annual average proportion of employees who had at least one MSD-related claim was 43% during the 5-year period of analysis. Female employees were more likely to have an MSD-related claim than males ($p<0.01$). Increased odds of an MSD were estimated for job families in production and maintenance (OR=1.1, p=0.02) and sales (OR=1.2, p=0.01). Decreased odds of an MSD were observed for job families in engineering (OR=0.8, p=0.02) and senior management (OR=0.7, p=0.03). Conclusion: Cross-sectional associations between MSDs are reported for 38 job families. Four job families had significant associations with MSD claims for more than one calendar year. The EWAS approach is helpful for assessing the general distribution of MSD prevalence among a large number of job families over multiple calendar years.

Abstract Number	**P-3-16-14**
Presenter	Jan Urbanas, Edith Berger-Preiss*, Wolfgang Koch, Sven Schuchardt
Exposure	organic compounds
Health domains	other
Type of research	exposure measurement

Evaluation of two sampling methods for the determination of gas oil mist and vapour in workplace air

Background: Inhalation exposure of workers to gas oil can occur in the refinery as well as during transport and use of the product. Exposure is characterized by the presence of aerosol determined by the high boiling compounds and vapour from the light end of the product and is typical for high-boiling liquids often referred to as semi-volatiles. The assessment of workplace exposure requires the determination of the total concentration, as well as partitioning of the vapour and the droplet fractions because of differences in the toxicity. Aim: Investigate performance of an existing and a novel sampling method under laboratory conditions: a conventional system of filter and XAD-adsorbent cartridge operated in series and a virtual-impactor (VI) combined with filter-XAD cartridges. Methods: Using a test stand for reproducible and stable generation of gas oil mists from liquid samples the two sampling method were tested for three gas oil products of different boiling ranges at different concentrations and thermodynamic conditions. The material collected was analyzed using an infrared method. Results: The conventional method allows for measuring the total concentration of the gas oil atmospheres for concentrations larger than 0.5 mg/m^3 for 8-hour sampling. Losses between 15 and 30 % were encountered when measuring the total concentration with the VI-method. In the conventional sampling system evaporation effects cause a shift of the aerosol-vapour partitioning towards the vapour phase of up to 50% and depends on the boiling range of the gas oil, the thermodynamic conditions during sampling and the sampling duration. In the VI-method the aerosol-vapour partitioning is nearly independent of these parameters. However, the partitioning coefficient may be influenced by the aerosol mass fraction in the submicron size range, falsely counted as vapour phase. Conclusions: Although the novel method is better able to quantify the vapour-mist partitioning, losses in the sampler may lead to underestimation of ambient concentrations if unaccounted for.

Abstract Number	**P-3-16-15**
Presenter	Hogi Ahn, Sunshin Kim*, Gayeon Hong, Seokyong Lee, Wonho Yang
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Exposure Assessment and Sources Estimation of Residents of Asbestos Abandoned Mining

This study was a report suspecting an asbestos-related health symptoms among the residents near asbestos abandoned mines located at the Chungcheong province. In addition, exposure assessment of asbestos is needed though exposure to asbestos was past. In this study, past exposure to asbestos on inhabitants near asbestos abandoned mines was estimated by using of surface sampling of deposited dust in indoor and outdoor residence.A total of 54 participants were divided into two groups with (34 cases) and without (20 controls) the diseases related to asbestos.Surface sampling of deposited dust was carried out in indoor and outdoor residence with collecting 105 samples. Deposited dust of sampling was analyzed by polarization microscope (PLM) and scanning electron microscope energy dispersive x-ray spectrometer (SEM-EDX) to detect the asbestos. Subsequently, the elements of deposited dust with asbestos were analyzed by SEM-EDX to assess the contribution of sources such as abandoned mine, slate and soil.Among 105 samples, asbestos was detected by PLM with 29(27.6%) sampling points, and detected by SEM with 56(48.6%) sampling points. Asbestos in indoor residence was detected by PLM with 4 sampling points, and 12 by SEM with 12 sampling points. Past residential asbestos exposure may be associated with asbestosis in the local resident nearby abandoned asbestos mines. Odd ratio of calculating with asbestos detection of outdoor residence between asbestos detection and asbestosis plutonium was 3.36 (95% CI 0.90-12.53) (p=0.072) adjusting for age, sex, smoking status and work history by multivariable logistic regression by PLM analysis method.To assess the contribution of sources, element composition of deposited dust by SEM and positive matrix factorization (PMF) developed from US EPA were used. Exposure pathway from asbestos mine to residence was directly from mines (30.3%) and indirectly by way of soil from mines (27.4%).

Abstract Number	**P-3-16-16**
Presenter	Fung-Chang Sung, Chin-Ching Wu*, Ya-Ting Chan
Exposure	metals
Health domains	autoimmune disease
Type of research	occupational study

Exposure Assessment for Workers at Antimony Industry in Taiwan and the Association with Immunologic Function

Backgroud. Antimony exposure has been associated with the compensatory activation of immune function. Studies have rarely investigated this association for industrial workers with exposure to the chemical at work. Aims. This study investigated antimony exposure among workers at manufacturing industries in Taiwan and the relationship between antimony exposure and immunologic function. Methods. A total of 133 male workers, including 41 administrative workers, were recruited from two glass manufacturing plants, one antimony smelting and two engineering plastic plants. Air samples were collected at worksites. Each participant provided specimens of urine, blood and hair for the assay of Sb, and As, Pb and Cd as well. IgA, IgE and IgG in blood specimens were determined. Results. The mean antimony concentrations in air at the antimony smelting operation (1.05 mg/m3) and in blood (2.81±0.42 μg/l), urine (7.84±3.15 μg/g Cre) and hair (0.22±0.15 μg/g) samples of the workers were significantly higher than those associated with engineering plastics manufacturing and glass manufacturing plants. The Sb concentrations in worksites air samples at the antimony trioxide manufacturing factory was 2.1-fold of the TWA-PEL level of 0.5 mg/m3. Glass manufacturing workers had a higher exposure to As in the air, with significantly higher mean As levels in their blood, urine and hair samples. They also had significantly higher Cd exposure from the air with higher cadmium in urine and higher Pb in blood, urine and hair. However, we failed to find significant associations between the immunologic function and antimony exposure levels for workers. Conclusions. Higher Sb exposure was found for workers at the antimony trioxide manufacturing factory. But, the exposure is not high enough to alter immunologic function. Key words: Antimony exposure, antimony trioxide manufacturing, engineering plastics manufacturing, glass manufacturing, immunologic function. (NSC99-2314-B039-032-MY2.)

Abstract Number	**P-3-16-17**
Presenter	Branislav Kolena*, Tomáš Pilka, Zuzana Pucherová, Viera Vanková, Peter Petluš, Zdenka Rózová, Zita Jenisová, Ida Petrovicova
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

FACTORS OF WORK ENVIRONMENT AND HEALTH STATUS OF WORKERS IN CONDITION OF PLASTIC INDUSTRY OF SLOVAK REPUBLIC

Background: Some work environments can greatly affect human health especially in cases where workers are exposed to both detrimental conditions and noxious agents in the work-place and also harmful environmental and lifestyle factors. Aims: Because of the potential human toxicities of phthalates there was realized a cohort study in environmentally exposed group of individuals in plastic industry. Methods: AQM60 Environmental Station, DustTrak DRX8533 and VaisalaWXT520 was used for the air quality detection. Urine were collected from 22 individuals, analyzed for parent phthalate compounds and hthalate metabolites using HPLC MS/MS. Personal questionnaire, spirometry and anthropometry were examined by standard methods. Results: CO, NOx, SO2, CO2, VOC, PM1, PM2.5, PM10 and total dust were detected in the production hall at higher levels. Symptoms of chronic obstructive pulmonary disease (4.5%) and chronic mucopurulent bronchitis (50.0%) were detected. There was a tendency towards increased for man and women in BMI (26.8; 28.2), FMI (6.2; 11.0), FFMI (20.4; 17.21) and WHR (0.96; 0.89). All individuals had MEP – monoethyl phthalate, MBP – monobuthyl phthalate, MEHP – monoethylhexyl phthalate and MiNP – monoisononyl phthalate in their urine samples, suggesting widespread phthalate exposure. Tolerable daily intake (TDI) was exceeded in di-2-ethylhexyl phthalate DEHP (59 µg/kg/day). DiNP (diisononyl phthalate) was higher in individuals with airways diseases (7.24 µg/kg/day) than others. Conclusions: Unsatisfactory working conditions (combination of higher temperature, low relative humidity, presence of phthalates) may have a negative impact on human health. We suppose on potential effect of phthalate exposure as a causative factor for presence of airways diseases. This study is the result of implementation of projects: “Environmental aspects of urban area” (ITMS: 26220220110) supported by the Research & Development Operational Programme funded by the ERDF; VEGA (I/0042/12).

Abstract Number	**P-3-16-18**
Presenter	Fu-Jen Wang*, Meng-Chieh Lee, Rong-Chin Jung, Yong-Sheng Chen, You-De Ke
Exposure	no exposure
Health domains	no health domain
Type of research	occupational study

Field Measurement Investigation of Improving Indoor Air Quality by Total Heat Exchanger in an Office Building

Indoor air quality affects working quality and efficiency particularly for those who work in the office for prolonged period. Poor air quality even compromises health of the staff in the office. For the air-conditioning system using package type or split type air conditioner, introducing the fresh air will improve the indoor air quality of the office. However, it will increase the energy consumption of the air-conditioning system. Attempting to improve indoor air quality with less power consumption, this study conducts the case study of a total heat exchanger retrofitted in an office building in Taiwan. Field measurement of indoor temperature, humidity, CO2 concentration and energy consumption have been compared comprehensively after installing the total heat exchanger. Results indicated that the CO2 concentration decreases obviously and thermal comfort evaluation improves satisfactorily after the installation of total heat exchanger even though power consumption increased slightly. It reveals that it is feasible to improve the indoor air quality effectively with less power consumption approach in the office specifically for the air-conditioning system using package type or split type air conditioner.

Abstract Number	**P-3-16-19**
Presenter	Mayank Mathur*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	occupational study

Implications of home based working on Micro-environment and health: case study Aligarh

A town near the capital of India named Aligarh is famous for lock manufacturing and metal products. A research was undertaken to study the impact of the phenomenon of home based working on microenvironment and health of the inhabitants. The primary survey was done to gather information on socio-economic characteristics and spaces etc. Subsequently interviews and focused group discussions with home based workers was made to explore the process of manufacturing, use of raw materials, roles of various individual workers and tools and implements used for manufacturing. Interviews with professionals such as Medical Private Practitioners practicing close to these settlement areas was made to know about the health conditions of these inhabitants. It was envisaged that poor health of these inhabitants may be due to the unhealthy microenvironment and finally a scientific survey was also conducted to explore the quality of microenvironment in these areas, with the help of scientific instruments and the laboratory analysis at Central Pollution Control Board, Delhi. The findings of research study are as follows: it was found that there were dual role of family members. Head of the family imparted training to family members and the manufacturing trade progressed from father to son. Women workers involved in such home-based working combined work with their domestic responsibilities. Incidence of child labour is significant, although head of the family provides less hazardous work to their children. Survey revealed that the workers in the family had severe respiratory problems and therefore an indoor air quality assessment was conducted. The pollution level was found to be quite alarming in case of CO, NO2, SO2 and Suspended Particulate Matter. issues of health and microenvironment needs to be addressed urgently to take care of the existing settlements and in subsequent developments where such target group are expected to come.

Abstract Number	**P-3-16-20**
Presenter	Ching-An Feng*
Exposure	ambient air pollution
Health domains	allergies
Type of research	occupational study

Indoor Air Quality Assessment of Coffee shop

In recent years, the Coffee roasting business is booming in Taiwan. Home roasting coffee shops have opened one by one which bring more workforces into the roasting industry. The character of coffee roasting oil fume is like that of cooking oil fume. We review the cooking's health exposure assessment by Chinese woman, and we find the oil fume induced lung disease. It results from immediately roasting coffee in coffee shop by coffee worker because consumers claim fresh coffee. The coffee worker exposures to oil fume by coffee roasting. We study the indoor air quality of coffee shops and use questionnaire to survey coffee worker's risk. In this study, we choose home roast coffee shop and non-roast coffee shop in order to understand the changes of the indoor air quality in the coffee shop by the area measurement. The coffee shop is divided four areas-outdoor area, roast areas, brew coffee area, and seat areas. The measurement period is eight hours inclusive of 24 hours of continuous monitoring, and collecting sample of total dust. Total examination parameters are respectively formaldehyde, CO2, CO, VOCs, particle sizes, TSP, temperatures, relative humidity. Comparing numerical analysis of Taiwan indoor air quality with the standard of WHO indoor air quality. We find roast coffee shop that formaldehyde, CO2, CO, VOCs, temperatures data are higher than the standard,non-roast coffee shop is meet the standards. According to questionnaire survey, the coffee worker gives a description of respiratory allergies and musculoskeletal disorders, such as skill, pate, shoulder and low back pain. The result comes that roasting is the main source of the polluted indoor air. We suggest the electrostatic precipitator be set up and maintained because ventilation reduces chemical pollutant and decreases the health risk in a suitable and restful environment.

Abstract Number	**P-3-16-21**
Presenter	Alina Handorean, Greg Kok, Darrel Baumgardner, Gary Granger, Brent Stephens, Mark Hernandez*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	occupational study

Leveraging multi-band fluorescence monitoring calibrated to track bioaerosols in sensitive indoor environments

Ultraviolet laser induced fluorescence (UV-LIF) is gaining increased attention for its ability to discriminate between airborne particles with and without materials of primary biological origin. While research grade instruments have demonstrated the sensitivity and utility of particle fluorescence in recent outdoor field trials, a new generation of multi-channel UV-LIF devices are being produced which make them affordable for industrial hygiene applications, particularly in health care settings and building reclamation assessments. We report here the application of a Waveband Integrated Bioaerosol Sensor (WIBS-4) to track indoor bioaerosols. Prior to deployment, a WIBS instrument was calibrated in environmentally controlled chamber studies with pure cultures of airborne vegetative bacteria, bacterial spores, fungal spores and pollen grains. Following calibrations, the instrument was used to continuously monitor airborne particle loads before and after the occupation of new, HEPA-filtered hospital wards hosting immunocompromised and potentially contagious populations. As judged by intensity, distribution and abundance of fluorescent particles, real-time WIBS monitoring was sensitive to occupation and room function (e.g. positive pressure, HEPA filtration). Bioaerosol particle loads were consistent with other common indoor air quality parameters, including effective air exchange rates and room filter loading, as well as local worker activities (e.g. linen exchange). Given the relative potential for lowered aerosol interferences in specialty indoor environments, multi-channel UV-LIF may offer reliable method for monitoring and tracking indoor bioaerosols in sensitive health care settings.

Abstract Number	**P-3-16-22**
Presenter	David Basketter*, Francis Kruszewski, Sophie Mathieu, Donald Bruce Kirchner, Anthony Panepinto, Mark Fieldsend, Volker Siegert, Fiona Barnes, Robert Bookstaff, Hans Erik Schiff, Beth Concoby
Exposure	others
Health domains	allergies
Type of research	occupational study

Managing the Risk of Occupational Allergy in the Enzyme Detergent Industry

Background: Enzyme proteins have long been recognised to have a potential to cause occupational allergy. Consequently, as users of enzymes in formulated products, the detergents manufacturers have chosen to implement a number of control measures to ensure that the hazard does not translate into health effects in the workforce. To that end, the trade associations, the American Cleaning Institute and the International Association for Soaps, Detergents and Maintenance Products, have developed best practice risk management guidelines providing occupational hygiene and medical monitoring as part of an effective exposure control strategy. The need for businesses to recognize the utility of the available guidance is reinforced by reports where factories failure to following good industrial hygiene practices can give rise to incidences of occupational allergy. Aims: In this presentation, an overview is provided of how the industry guidelines are actually implemented in practice and the resulting experience of workplace exposures and health impacts. Methods: Both medical surveillance and air monitoring practices associated with the implementation of industry guidelines at over 100 manufacturing facilities are evaluated with respect to the prevalence of allergic antibody and occupational respiratory allergy. Results and Conclusions: The data show that using the approaches described for the limitation of exposure, for good occupational hygiene, and for active health monitoring, the respiratory allergenic hazard associated with enzyme proteins can been successfully managed to ensure the safety of the workforce.

Abstract Number	**P-3-16-23**
Presenter	Chih-Neng Hsu*, Hong-Yue Chen, Ming-Te Chao
Exposure	others
Health domains	other
Type of research	exposure measurement

Micro-dusty Measurement and Analysis of the Surgery Light Disease Burn Injuries Medical Ward Environment Renovation

Background:The hospital indoor ventilation circulation and environment would use air-conditioning to keep good quality is very important. In general, the hospital air-conditioning needs to consider the patient's state could be divided into the infected area (for example surgery and burns ward) for positive pressure wards and infection area (for example TB or SARS patients) for negative pressure wards, and medical staff, patient protection, mobile route, location of the supply air and return air, and moving lines should be also considered path line. It would reduce the design loading and maintain excellent medical ward environmental quality. Aims:This paper studyis focusing on micro-dusty measurement and analysis of the regional hospital the surgery light disease burn injuries medical ward environment renovation.Methods:This paper has been used to measure equipment and specification, including micro-dusty counter and multi-function ventilation testing instruments (TSI/9565-P) for indoor positive pressure, temperature, relative humidity, and velocity measurement. Results:The burn injuries medical ward temperature is between 22.3°C and 22.4°C, and meet design standard is the 23°C±2°C. Relative humidity is between 54.5% and 54.7% RH is also met design is the 55%±5% RH. The air velocity is between 0.34m/sec and 0.41m/sec is also under 0.5m/sec for ISO14644-1 standard. The return air velocity is between 1.46m/sec and 1.69m/sec with it is not over 2.0m/sec. Conclusions:This paper has successfully been measured and analyzed the burn injuries medical ward micro-dusty, temperature and relative humidity, ventilation circulation, velocity, positive and negative pressure, environmental quality through the redesign and construction ward. All of the position micro-dusty particle size is less than the 0.5µm with it is good agreement meet the ISO 14644-1 standard class 100,000, and it is also met the as-built state the ISO 14644-1 standard class 10,000.

Abstract Number	**P-3-16-24**
Presenter	Christos Nikolaidis*, Aikaterini Chatzaki, Athanasios Tselemponis, Theodore Constantinidis
Exposure	others
Health domains	healthrelated quality of life
Type of research	health impact assessment

Mortality in the agricultural sector in Greece: evidence from life tables and working life expectancies.

Background: Agricultural populations may be prone to occupational and environmental exposures that have a profound impact on their health and quality of life. However, it is often neglected that these populations are also rapidly ageing, which generally affects their well-being and overall exposure outcomes. Aims: To illustrate the impact of ageing on agricultural mortality with the use of life tables and working life expectancy using the Greek population as an example. Methods: Census data of the Greek population were used to construct abridged life tables for males and females from which the life expectancy at given age (ex) was calculated. Data for occupationally active population by age, gender and sector of employment were used to compute the working life expectancy. Withdrawal from the labour force due to death or retirement was analyzed in this manner. Population pyramids were created to account for differences in demographics between the study groups. Results: Withdrawal from the labour force of males in Greece was attributed to 16% mortality and 84% retirement reasons. In the agricultural sector this proportion was equivalent to 23% death and 77% retirement. In females the analogy was 5% mortality and 95% retirement for the general population and 8% death plus 92% retirement in the agricultural sector. The median age of the agricultural population (both sexes) was 45.1 years with the dominant age group being 50-54 years old. In the general labour force the corresponding median age was 38.3 years and the dominant age group was 30-34 years old. Conclusions: Although it appears that a larger percentage of deaths occurs in the agricultural sector, it is important to notice that specific demographic differences control the dynamics of the opposing population groups. Males and females employed in agriculture often experience stronger ageing forces additionally to other exposures, which may have a detrimental impact on their general health status and prognosis against risk factors intrinsic in their occupation.

Abstract Number	**P-3-16-25**
Presenter	Katharine Hammond*, Sa Liu, Sophia Horiuchi, Brooke Donovan
Exposure	neurotoxin
Health domains	neurodegeneration
Type of research	occupational study

Neurologic and reproductive effects of solvents on automotive repair workers: Assessment of Exposure for the Bay Area Solvent Study (BASS)

Background: Peripheral neuropathy was diagnosed in automotive technicians visiting an occupational health clinic, although subsequent measurements indicated exposures to n-hexane, used for cleaning, were low. Furthermore, animal studies suggest n-hexane may also cause testicular toxicity. Aims: This epidemiologic study aims to investigate neurologic and reproductive effects of solvents on automotive repair workers. Methods: Industrial hygienists evaluated work practices of automechanics through site-visits, air measurements, and interviews to prepare questions about the frequency of task performance, work practices, and products used for an occupational history. Participants were recruited from the International Association of Machinists and Aerospace Workers. Clinical exams included tests for peripheral neuropathy, neurocognitive effects, color discrimination, time to pregnancy, and urinary reproductive hormonal metabolites. Results: The 835 participants who visited the BASS clinic for a two hour interview and examination had worked over 3,000 jobs at 1,952 shops. Algorithms were developed to estimate solvent exposures in each year (average intake of solvents each day) by integrating self-reported frequency of performing tasks (e.g., use of aerosol spray cans and solvent tanks) with MSDSs, measured and modeled airborne concentrations and estimates of dermal absorption. Major changes occurred in source of exposures over time, e.g., cleaning with solvent tanks accounted for 71% of solvent exposures in the 1960s, 30% in 2000-04, but only 7% in 2005-2012; concomitantly, exposures from aerosol cans rose from 23% to 64% and then 84%, and composition changed dramatically, notably for hexane and perchloroethylene. Conclusions: Work histories were more complex than indicated in the pilot of 39 mechanics. Exposures were significantly affected by temporal trends in cleaning methods, composition of materials, and work practices. Epidemiologic studies must account for these changes.

Abstract Number	**P-3-16-26**
Presenter	Elizabeth Boyle*, Pabitra Josse, Maire S.A. Heikkinen, Susan Marie Viet, Michael Dellarco
Exposure	no exposure
Health domains	no health domain
Type of research	cohort study

Operational considerations for field data collection of water and dust samples in the home

Background: Epidemiological studies include water and dust samples to measure exposure to a variety of contaminants. These matrices are used because they are considered inexpensive and easy to collect. Aims: To examine the operational feasibility of collecting water and dust samples, the National Children's Study (NCS) Vanguard Study collected samples from the homes of participants in select study locations from the spring 2011 to the fall 2012. Methods: At the first pregnancy visit the following environmental samples were collected, a water pharmaceuticals sample, a water pesticides sample, and a bulk dust sample. The water samples were collected in one-liter plastic bottles with 50 mg ascorbic acid preservative. Three bottles were filled for the pharmaceuticals sample and two bottles were filled for the pesticides sample. Both water samples were collected from the kitchen tap after a five minute flush. The bulk dust sample was collected by obtaining the vacuum bag or the dust from the vacuum, wrapping it in aluminum foil, and placing it into a plastic bag. The samples were then taken to the study center in a cooler filled with ice packs, logged into the study sample tracking system, and stored at 4 oC (water) or -20 oC (dust). The water and dust samples were shipped for long term storage on ice packs and dry ice, respectively. At the repository, the water and dust samples were stored at 20 oC. Results: By September 2012, the NCS collected over 380 tap water pharmaceutical samples, over 370 tap water pesticide samples, and over 270 bulk dust samples. The response rates to the collections were all over 70 percent. Reasons samples were not collected include no vacuum in home and participant refusal. Conclusions: Although water and bulk dust samples are easy to collect, they are not without operational issues. Participants may not have vacuums; also, when an analysis method requires a large volume of water it can pose problems with transport, shipping, and handling.

Abstract Number	**P-3-16-27**
Presenter	Hsiu-Ling Chen*
Exposure	metals
Health domains	no health domain
Type of research	occupational study

Particle size distributions, metals exposure concentrations and removal of welding fume in workplace of fitness equipments manufacturing industry

BackgroundWelding operations produce gaseous and particulate hazards containing metals, reactive oxygen species (ROS). The previous studies demonstrated that the particle sizes of welding fume range from ultrafine to fine. The fine particles from welding processes are considered to be composed of spherical and aggregated particles formed due to the high temperature. AimsThe study aims to assessthe particle size distributions and exposure concentrations of welding fume in workplace atmospheres of fitness equipments manufacturing industry. Methods In this study, the industry manufacturing fitness equipments in Chang-Hua county was selected for measuring the exposure hazards of welding fume. IOM and Marple for inhalable and particle size distribution sampling were processed respectively. Meanwhile, an exposure chamber experiment to explore the removal efficiency for welding fume by using alternative masks to remove inhalable dust and heavy metals, which were analyzed by ICP-OES. ResultsThe results showed that the concentrations of inhalable welding fume were in powder coating area (15.58mg/m3)> automatic welding area (0.66 mg/m3)> manual welding area (0.53mg/m3)> punch area (0.18 mg/m3)> Cutting area (0.16 mg/m3). The mass median aerodynamic diameter (MMAD) of coarse particles ranged from 9.65µm-9.93µm, fine particles: 0.66µm-1.2µm. Aluminum is one of major heavy metal in power coating area inside the fitness equipments industry; iron is in welding operation area; iron and aluminum in punch and in cutting area.In the exposure chamber experiments, chromium, nickel are the major sampling inside exposure chamber while using stainless steel electrode. Conclusion The size distribution of welding fume showed bimodal distribution in manufacturing fitness equipments. The welding operation area in fine aerodynamic mass median diameter is less than other areas without welding works.

Abstract Number	**P-3-16-28**
Presenter	Natalia Salazar*, Juan P. Ramos-Bonilla, Maria F. Cely-Garcia
Exposure	others
Health domains	respiratory disease
Type of research	occupational study

PERSONAL EXPOSURE TO ASBESTOS FIBERS AMONG TRANSMISSION MECHANICS IN REPAIR SHOPS IN BOGOTA, COLOMBIA

Background: In Colombia the transmission system of vehicles still use asbestos containing clutch discs. Clutch discs are sold separated from the clutch plates (i.e., support). Thus, it is necessary to manipulate the discs in order to attach them to the plate before installation. These activities may release asbestos fibers, which may expose workers. Aims: Estimate personal exposures to asbestos fibers among transmission mechanics that manipulate asbestos containing clutch discs, in repair shops located in Bogotá, Colombia. Methods: Personal and area samples were collected and analyzed following NIOSH methods 7400 and 7402, in a transmission repair shop. Samples were collected during three consecutive days for the entire working shift (8am-6:00 pm). Personal samples and short-term personal samples (30 min.) were collected in the respiratory zone of three workers (i.e., two riveters and one administrative staff). Results: A total of 75 air samples were collected during the monitoring campaign (i.e., 60 personal samples, 11 area samples, 3 blanks, and 1 background). The 8-hr TWA personal fiber concentrations for riveters ranged between 0,066 to 0,169 f/cc (PCM). The manipulation of clutch discs (i.e., drilling, countersinking, riveting, manual grinding, and in some occasions grinding with a machine) was the activity associated with the highest personal exposures. Other activities associated with high exposures included volatilization of fibers because of working on contaminated surfaces and dry cleaning of the manipulation equipment. Personal samples of administrative staff did not indicate high fiber exposures. Conclusions: Few studies have been conducted to understand the risks of this occupational group, and none of the previous studies cover the manipulation activities observed in the current study. This study suggests that workers manipulating asbestos containing clutch discs maybe exposed to high fiber concentrations.

Abstract Number	**P-3-16-29**
Presenter	Kenichi Azuma*, Koichi Ikeda, Naoki Kagi, U Yanagi, Tomoko Shimodaira, Haruki Osawa
Exposure	others
Health domains	healthrelated quality of life
Type of research	occupational study

Relationship of the risk factors for indoor air quality, work environment, and occupational stress with the symptoms of employees working in office buildings

Nonspecific building-related symptoms, sometimescalled sick building syndrome, have emerged as an occupational and environmental health issue since the early 1970s. The Building Sanitation Management Standards, which specified management standards for the maintenance of indoor air quality and other such factors, were established in 1970 in Japan. However, the excess ratios against the standards in temperature, relative humidity, and carbon dioxide have increased in the recent decade in Japan. We conducted a nationwide questionnaire survey to examine the association between environmental factors and the symptoms of employees working in office buildings during winter season in Japan. Surveys were conducted from January 2012 to March 2012 in 315 office workplaces with 3335 employees. We administered detailed questionnaires to obtain information on work-related symptoms, indoor air quality, perceptions of office environments, and occupational stress. Prevalence of eye irritation, nonspecific symptoms, and upper respiratory symptoms related to work environments was more than approximately 10%; that of lower respiratory symptoms was very low at 0.8%; and that of skin symptoms was 4.5%. In multivariate analyses, eye irritation was significantly associated with extreme cold and dryness, static electricity, and wind from air conditioner. Nonspecific symptoms were significantly associated with extreme cold and dryness, noise, dust, odors, interpersonal stress, irritability, and anxiety. Upper respiratory symptoms were significantly associated with extreme dryness, dust, odors, and crowded workspace. Lower respiratory symptoms were significantly associated with smoking, varying room temperatures, and noise. Skin symptoms were significantly associated with extreme dryness, noise, odors, and fatigue. This study suggests the importance of improving office environments in terms of factors that affect the health of employees, such as coldness, dryness, noise, dust, and odors.

Abstract Number	**P-3-16-30**
Presenter	Derese Belay*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	occupational study

RESPIRATORY STATUS OF WORKERS FROM THE EMISSION OF PREHARVESTING OF SUGARCANE BURNING at METHARA SUGAR FACTORY.

The objective of the study was to determine the health status of cane cutters and cane collectors who are exposed to suspended particulates from pre-harvesting sugar cane burning in Methara sugar factory. The design of the study was cross-sectional, 160 cane cutters against 89 control groups . Lung function measurement results revealed that FVC, FEV1, PEFR and MMF of cane cutters significantly decreased with an increasing age . Two tailed paired sample T- test shows that measured values of FVC and FEV1 both for cane cutters and cane collectors were significantly lower than respective predicted values. Appropriate personal protective devices to mask nose and mouth which are the major routes of entry must be frequently supplied and strong regular medical checkups must be employed.

Abstract Number	**P-3-16-31**
Presenter	Ronnie Levin*, Joel D. Schwartz
Exposure	metals
Health domains	costs
Type of research	occupational study

The attributable costs of US occupational lead exposure

Background Occupational standards for lead have not been changed for decades, during which time our knowledge of lead's extensive toxicity has grown substantially, and ever-new health outcomes and lower exposures associated with those outcomes are a general pattern. Aims To estimate the annual medical costs and damages to the approximately 11,000 US workers occupationally exposed to lead Methods Using a cost of illness approach, we used existing literature on adult health effects and costs to estimate the annual damage to US workers with occupational lead exposure. Categories of health effects include neurotoxicity, reproductive toxicity, cardiovascular disease, kidney damage, genotoxic and carcinogenic effects, immunotoxicity, ocular damage and biochemical changes; in general, only 1 health end point from each category is included. Results Payer and private medical costs alone are estimated at $40 million (2009$) per year, and total direct and indirect costs are estimated at at least $117-142 million (2009$) per year for the 11,000 or so occupationally lead-exposed workers in the US. Conclusions Reducing allowable lead limits could result in estimated benefits of $10,000-13,000 per worker per year, suggesting that cost effective reductions are likely to be possible.

Abstract Number	**P-3-16-32**
Presenter	Hsiu Hao Lee*, Chuen-Den Tseng, Pau-Chung Chen, Yue-Liang Guo
Exposure	others
Health domains	cardiovascular disease
Type of research	occupational study

The dose response effect of duty loading stress, caused by increased sympathetic tone, on blood pressure of physicians of internal medicine

Background: The relationship between working stress and cardiovascular disease is more and more emphasized. Interest in dose response effect between stressor and stress response is growing, and more effective strategies for prevention of stress related diseases are needed. Aims: The aim of this study was to evaluate the stress burden of physicians of internal medicine with duty loading and how duty loading stress inference heart rate variability, blood pressure and other stress indicators. Methods: This was an unallocated prospective observational trial at departments of internal medicine of Taipei city hospital, Zhong-Xing branch from 2011 to 2012.The heart rate variability, blood pressure and other stress indicators of 12 attending physicians of internal medicine during with different duty loading (non-duty day, one duty area with 3 wards, and 2 duty areas with 6 wards) were compared. Results:Blood pressure was affected by different duty loading as well as sympathetic tone. Physicians on 1 or 2 duty areas day compared with non-duty area day had a greater 24 h SBP (125.3mmHg or 126.3 mmHg VS 120.3mmHg, P=0.0042 & 0.0222).As the duty loading increased, the SBP and DBP increased gradually during night-time compared with the control day (110.0/66.4mmHg, 116.0/71.3 mmHg 120.5/74.3 mmHg P=0.0130/0.0053). The physicians also had higher rate of abnormal SBP (20.3%, 36.3% and 47% P= 0.0196) and DBP (6.2%, 19.7%, and 28.3%P =0.0091) as the duty loading increased. Physicianson 2 duty areas day compared with non-duty area day had higher low-frequency normalized units (LFnu) (P =0.0043), LF/HF ratio (P=0.0216), Lfnu 5PM-8AM (P=0.0360), and Hfnu 5PM-8AM (P=0.0329) and a lower high-frequency normalized units (HFnu) (P =0.0035). Physicians on 2 duty areas day compared with with 1 duty area day had a higher LFnu (P=0.0453). Conclusions: The findings of this observational analysis revealed that there might be a dose response effect of duty loading, caused by increased sympathetic tone, on blood pressure of physicians of internal medicine.

Abstract Number	**P-3-18-01**
Presenter	Hyunjoo Joo*, Myungho Lim, Ki-Chung Paik, Sungja Cho, Hojang Kwon, Seung Jin Yoo, Kyung-Hwa Choi, Mina Ha
Exposure	biomarker
Health domains	mental health
Type of research	case-control study

A Case Control Study on Blood Lead, Urinary Cotinine and Attention Deficit Hyperactivity Disorder in Children

<Background>As risk factors for attention deficit hyperactivity disorder (ADHD), prenatal smoking and lead exposure and their synergistic effect of simultaneous exposure have been reported. < Aims>The purpose of this study is to investigate associations between blood lead, urinary cotinine levels and ADHD including a possible synergistic effect of the lead and cotinine on ADHD in children. <Method> Based on a community survey for ADHD screening using the Korean version of ADHD rating scale in elementary schools of Cheonan city, a case control study was designed to examine environmental risk factors for ADHD. Cases and controls were confirmed by a pediatric psychiatrist through a thorough clinical work-up. Controls were selected by individual age and gender matching with the cases. A total of 214 cases and 237 controls aged 6-10 were included in the present study. Measurements of blood lead concentration and urinary cotinine level and questionnaire administration to obtain information on general characteristics, socio-demographic and various confounders were done at the time of participants' hospital visits. Analysis was performed using multiple logistic regression model adjusted for confounders and covariates. <Results>Geometric means (geometric standard deviation) of blood lead and urinary cotinine levels were 1.64 (1.46) ug/dL and 1.78 (3.81) ng/mL in ADHD cases and 1.47 (1.47) ug/dL and 1.15 (2.73) ng/mL in controls, respectively. Risk of ADHD associated with blood lead level: odds ratios of 1.90 (95% confidence intervals =1.06-3.38) for the highest quartile compared to the lowest of lead level. ADHD risk showed a significant increase according to increasing urinary cotinine level (p-trend=0.004). However, the synergistic effect of blood lead and urinary cotinine on the risk of ADHD was not significant. <Conclusion>Exposure to lead and tobacco smoke associated with risk of ADHD and a non-significant synergistic effect was found in children.

Abstract Number	**P-3-18-02**
Presenter	Soo Eun Chung*, Hae-Kwan Cheong, Eun-Hee Ha, Boong-Nyun Kim, Mina Ha, Yangho Kim, Yun Chul Hong, HyeSook Park
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

A Prenatal Blood Manganese Exposure Level

Background Manganese (Mn) is an essential trace element for normal development and body function at low doses and toxic metal at high doses. Excessive exposure of manganese has been associated with toxicity in neurological, pulmonary and reproductive systems. Prenatal consistently exposures are more harmful in utero environment than general environmental. It might be adversely influence on last of neonate's life. Aims In this study, we investigated the relationship between the effect of prenatal manganese exposure on fetal and children's growth from a birth cohort in KOREA. Methods We analyzed data from the birth cohort from Mothers and Children's Environmental Health (MOCEH). The study population included 324 pregnant women in the third trimester. We measured biparental diameter (BPD), abdominal circumference (AC) and femur length (FL) using fetal ultrasound. After birth, children's body weight and height were measured at delivery, 6, 12 and 24month. The relationship between prenatal Mn exposure and growth factors was assessed using linear regression and mixed models. Results Mixed linear regression analyses showed that high blood Mn levels were related to reduced weight and weightfor 24 months of age significantly and consistently. Below the high level of Mn (≥35.0 μg/L) with exhibited positive associations between blood Mn and weight-for age at 6,12 and 24 months, and with height-for-age at birth, 6 ,12 and 24 months, but high level Mn did not have any negative associations. Conclusions The results of the study showed that prenatal manganese exposure has both positive and negative impacts on fetal growth and development. It suggest that prenatal exposure to Mn may result in detrimental effects on the body development of the fetus and babies up to 24 months of age

Abstract Number	**P-3-18-03**
Presenter	Ruth Ruggles, Catherine Keshishian*, Raquel Duarte-Davidson, Rebecca Close, Eirian Thomas, Sally Bradberry, Emer O'Connell, Rachel Knowles, Virginia Murray, Giovanni Leonardi
Exposure	metals
Health domains	neurodevelopment
Type of research	others

A SLIC response to lead and health

Background The World Health Organization estimates that lead is responsible for 143,000 deaths per year and 0.6% of the global burden of disease. However, prevalence rates for lead poisoning and the severity of outcomes vary greatly from country to country. In the UK, public health interventions have succeeded in removing most sources of lead from the human environment, however a small proportion of children continue to be exposed to harmful levels of lead, usually in the home. There are no reliable data on the incidence of lead toxicity in children in the UK or Republic of Ireland (ROI). Aim Surveillance of raised Blood Lead levels In Children (SLIC) is a Health Protection Agency (HPA) study aiming to provide an estimate of the incidence of blood lead concentrations ≥10µg/dl in the UK and ROI. Methods Cases were recruited over 24 months, using the methodology developed and managed by the British Paediatric Surveillance Unit for reporting of selected paediatric conditions by clinicians. To increase data capture, toxicologists and Supra-Regional Assay Service Trace Elements laboratories are also involved in case reporting. We will estimate incidence and use this information to identify the location of likely hotspots for exposure to lead in the UK and ROI. Results A successful system was established for reporting of cases by clinicians and laboratories across the countries involved. Cases were recruited from June 2010 to May 2012, and follow up is ongoing to link clinical and laboratory reports and remove double counting. Conclusions Childhood lead poisoning is preventable. The SLIC project will provide important information on both the clinical and public health management of lead poisoning cases in the UK and ROI. In all cases of lead toxicity globally, prevention should be a primary public health objective. Initiatives seeking greater national and international collaboration will help us to better understand and address the health challenges that lead presents.

Abstract Number	**P-3-18-04**
Presenter	Meiqin Wu, Chonghuai Yan*, Deqing Wu, Wei Wu, Hui Li
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Associations of Prenatal Lead and Mercury Coexposure with Neurodevelopment

Background: Humans are exposed to multiple chemicals, but most toxicologic studies focus on only a single agent, such as Lead, mercury or Manganese. So it can't reflect the truth. Aims: we prospectively examined whether coexposure to lead and mercury causes neurodevelopmental deficiencies that are more severe than expected based on effects of exposure to each metal alone.Methods: Approximately 300 pregnant women who gave birth in hospitals during October 2008 and October 2009 were investigated and contributed a cord blood sample at the time of delivery for lead and mercury determination. Children at the age of 18 months (16 months 15 days to 19 months 15 days) were followed up by the Bayley Scales of Infant Development–III. And a questionaire survey was conducted to analyse related factors affecting 18-month-old children's physical growth and neurodevelopment. Results: Mean (±SD) cord blood concentrations at delivery were 45.70±19.54 µg/L for lead and 2.35±1.49 µg/L for mercury. Factorial design technique didn't show any association of coexposure with Cognitive (F=0.231, P=0.631), Language (F = 2.175, P = 0.142), or Motor (F =0.058, P=0.810) development.Conclusions: We didn't observe evidence of synergism between lead and mercury, whereby lead tox-icity was not increased among children with high mercury coexposure.

Abstract Number	**P-3-18-05**
Presenter	Monica K. Silver*, John D. Meeker
Exposure	metals
Health domains	other
Type of research	cross-sectional study

Blood Cadmium is Elevated in Iron Deficient U.S. Children

Background- Iron deficiency (ID), lead (Pb) and cadmium (Cd) are known risk factors for neurodevelopmental disorders in infants and children. However, studies assessing cumulative effects of these factors together are lacking, especially in children. One concern, among others, regarding cumulative effects is for increased uptake of heavy metals in the presence of ID. Aim- Determine if blood Cd, urinary Cd and blood Pb levels are elevated in ID children compared to non-ID children. Methods- Blood and urinary Cd, blood Pb, and iron indicators from 5485 children, aged 3-19 years, were obtained from the 1999-2002 National Health and Nutrition Examination Surveys. ID was assigned if >=2 of 3 abnormal indicators (ferritin [FTN], % transferrin saturation [TFSAT], erythrocyte protoporphyrin [EPP]) were present. Linear regression was used to evaluate the relationships between iron status and blood Cd, urinary Cd (n=1508) and blood Pb, adjusted for gender, age, race/ethnicity, poverty and cotinine. Results- Prevalence of ID was 7.4% and 29.2% of children had >=1 abnormal iron indicator. Odds of ID increased with blood Cd (medium & high vs. <LOD), adjusted ORs=1.7 [95%CI: 1.4-2.2] & 2.6 [1.8-3.7], p-trend<0.0001. Odds of ID were also positively (though not as strongly) associated with urinary Cd, and negatively associated with blood Pb, though neither was statistically significant after adjustment for covariates. Continuous iron indicators yielded similar trends: FTN inversely associated with blood/urinary Cd and positively associated with blood Pb; TFSAT inversely associated with blood Cd and positively associated with blood Pb; EPP positively associated with urinary Cd and inversely associated with blood Pb. Conclusions- Current ID was associated with blood Cd, a biomarker of recent Cd exposure. Given their shared neurotoxic effects, and that many children live in areas with high burdens of both ID and heavy metals, research into these nutrient-toxicant interactions is vital.

Abstract Number	**P-3-18-06**
Presenter	Zishaan Farooqui*, Kelly Bakulski, Patricia A. Cassano, Avron Spiro III, David Sparrow, Pantel S. Vokonas, Linda Huiling Nie, Marc G Weisskopf, Howard Hu, Sung Kyun Park
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Effect Modification by MTHFR Polymorphisms of the Association between Cumulative Lead Exposure and Mini Mental Status Exam Score in Older Men

Background: Bone lead is a significant predictor of declines in scores on the Mini Mental Status Exam (MMSE) in older adults, indicating that accumulated lead burden may impact cognitive function. It is unknown if genes in one-carbon metabolism, especially methylene tetrahydrofolate reductase (MTHFR), modify the association between lead and cognitive function. Aims: To evaluate whether MTHFR polymorphisms modify the association between cumulative lead exposure and MMSE scores. Methods: A subset of men from the VA Normative Aging Study (n=588, mean age=68.5) had MTHFR genotypes, bone lead, and MMSE scores assessed. The cross-sectional relationships between bone lead and MMSE scores along with an interaction term between bone lead and MTHFR genotype were examined using multivariable linear regression. Results: MMSE scores were associated with 10 out of the 11 MTHFR single nucleotide polymorphisms (SNPs) genotyped (p<0.05). Interaction between tibia lead and genotype was significant for 4 out of 11 SNPs (rs1537516, rs17367629, rs13306556, rs1801133). Among men homozygous for the major allele for rs1801133 (functional SNP for MTHFR), an IQR difference in tibia lead (+16ug/g from 25th to 75th percentile of tibia lead distribution) was associated with 0.40 point decrease in MMSE score, while the corresponding effect in men homozygous for the minor allele was a 0.24 increase in MMSE score (p-interaction=0.028). At the other three loci, subjects with at least one copy of the minor allele were more sensitive to lead's effect on cognition. Conclusion: This study suggests that sequence variants in the MTHFR gene may influence vulnerability to lead's effect on cognitive decline. Future work will include haplotype analysis to determine how multiple genotypes interact with lead exposure.

Abstract Number	**P-3-18-07**
Presenter	Lertchai Charerntanyarak*, Somkid Prabpai
Exposure	metals
Health domains	other
Type of research	occupational study

Elevated blood-lead levels and air-lead levels among radiator repairer in Khon Kaen, Northeastern Thailand

Introduction: Lead is one of the best known toxic heavy metals. The level of lead in the blood is a highly reliable biological marker of recent exposure to lead. Objective:To examine blood lead levels (PbB), air lead concentration (PbA), and health behavior related to lead contamination prevention in radiator repair workers. Study Design: Cross-sectional study Setting Design: Radiator repair shops, Khon Kaen Province, Northeastern Thailand Subject: Blood samples and air samples in 63 radiator repair workers Method:PbB and PbA were measured for each participant concurrently by Graphite Furnace Atomic Absorption Spectrophotometry. A structured questionnaire was administered to collect socio-demographic characteristics, occupational history and health behavior related to lead contamination prevention. All data collected were analyzed by descriptive analysis. Result: The mean PbB and PbA were 23.46 mg/dL, ranging from 16.27 to 33.74 mg/dL and 3.63 mg/m3, ranging from 2.04 to 9.20 mg/m3, that lower than Bareau of occupational and Environmental Disease, Control Disease Division, Ministry of Public Health and the WHO recommended levels for PbB (PbB less than 40 mg/dL, PbA at workplace less than 0.2 mg/m3 for 8 hrs). However, the results showed the PbB > 25 mg/dL was 33.33% of the workers. There was no clear picture of association between PbB and PbA. Descriptive data of workers and protective equipment use did not change the substance of the results. Conclusion: The reduction of PbB in radiator workers to lower than the recommended limit and the low level of PbA could have been due to the result of a previous preventive study to reduce PbB for radiator repair workers and the improvement of their lead contamination prevention.

Abstract Number	**P-3-18-08**
Presenter	Yoon-Hyeong Choi*, Jin Hee Kim, Se-Young Oh, Yun Chul Hong
Exposure	metals
Health domains	cardiovascular disease
Type of research	others

Environmental Cadmium Exposure, Dietary Calcium Intake and Risk of Hypertension

Background: Cadmium is known to cause hypertension in animals, yet their association in epidemiologic studies has been inconsistent and mechanism of association is still unclear. Cadmium may interfere with biological functions of calcium which are critical to blood pressure regulation, but little is known about interactive effects of dietary calcium intake and cadmium on blood pressure or hypertension in general population. Aims:This study examined associations between blood cadmium exposure and hypertension and investigated whether intake of dietary calcium attenuates the effect of cadmium on hypertension in the elderly. Methods: We examined 417 participants between 60 to 87 years from a community-based panel of elderly. Blood cadmium levels were measured by graphite furnace-atomic absorption spectrometry, and daily dietary calcium intake was calculated from food frequency questionnaires. Logistic regression models were fit to evaluate the association of blood cadmium levels and calcium intake with a risk of hypertension, controlling for potential confounders. Results: Participants with higher cadmium exposure combined with lower calcium intake (vs. lower cadmium exposure and higher calcium intake based on cut-offs at median value) had significant odds ratios (ORs) for hypertension (2.6; 95% confidence interval (CI): 1.3 to 4.9) that was larger than ORs for those of higher cadmium exposure with higher calcium intake (1.7; 95% CI: 0.9 to 3.2) and lower cadmium exposure with lower calcium intake (1.9; 95% CI: 0.8 to 4.2). Conclusions: Our findings show that environmental cadmium exposure is an important risk factor for hypertension among elderly adults and suggest that diet containing an appropriate intake of calcium may attenuate the risk of hypertension attributable to cadmium.

Abstract Number	**P-3-18-09**
Presenter	Ferran Ballester*, Sabrina Llop, Mario Murcia, Xabier Aguinagalde, Maria-Jose Lopez-Espinosa, Eva Navarrete-Muñoz, Ana Esplugues, Daniel Giménez, Marisa Estarlich, Carmen Iñiguez, Marisa Rebagliato
Exposure	metals
Health domains	no health domain
Type of research	cohort study

Exposure to mercury at 4 years of life and associated factors in the INMA cohort in Valencia (Spain)

Background: Exposure to very high doses of mercury during vulnerable periods (such as the prenatal period or early childhood) is a risk factor for neurological development. In a previous study we observed elevated concentrations of prenatal mercury in 4 cohorts within the Spanish INMA project including the one in Valencia. In that study, mercury concentrations were associated with mother fish consumption during pregnancy. Aim: To determine hair mercury concentrations in children aged 4 years from the INMA-Valencia cohort and analyze their relation with sociodemographic factors and child's nutrition, specifically breastfeeding and fish consumption. Methods: The study population was 580 children from the INMA-Valencia cohort. Hair samples as well as child's diet frequency were collected during the visit at 4-years of age. The relationship of hair mercury concentrations in logarithm scale with fish intake at 4 years, breastfeeding, parental sociodemographic variables and cord blood mercury concentrations was analyzed using multivariate linear regression. Results:The geometric mean concentrations of mercury was 1.10 ppm (95% CI: 1.02 to 1.19), the 95th percentile was 5.13 and 5 children had concentrations above 10 ppm. Multivariate analysis showed a negative significant association ($p < 0.05$) with parity and a positive one with cord blood mercury concentrations, the mother's age, and consumption of certain species of fish: sword fish, white fish and canned tuna, in this order. Conclusions: The concentrations found are high in relation to the recommendations of the major regulatory agencies (WHO, EPA). Fish consumption of some species such as swordfish is the major source of exposure in our population.Children's determination of mercury in hairin the whole INMA cohort will expand the knowledge on mercury exposure among Spanish children and will allow us broadly study the associated factors and its possible role in child neurodevelopment.

Abstract Number	**P-3-18-10**
Presenter	Taehun Kim*, Eun-Hee Lee, Young Lim Kho, Sangshin Park
Exposure	metals
Health domains	cardiovascular disease
Type of research	cross-sectional study

Heavy Metals and the 10-year risk of coronary heart disease in the adults: the 2008 – 2010 Korea National Health and Nutrition Examination Survey

Background: The lifestyle factors including cigarette smoking, alcohol drink, diet and exercise, are considered main environmental influences on the cardiovascular disease, whereas the contribution of environmental exposure of metals is less clear. There are several studies have identified that exposure to metals is associated with coronary heart disease. However, sex differences exist in this respect is not well studied. Aims: We assessed the association between heavy metals and risk of coronary heart disease in Korean adults. Methods: Relationships between heavy metals (cadmium, lead, mercury) and risk of coronary heart disease were evaluated by linear multiple regression models, with glomerular filtration rate (GFR) as confounding factors – in 4,491 adults (2,227 men, 2,264 women), aged 30 years and older, who participated in the 2008 – 2010 Korea National Health and Nutrition Examination Study. Results: After adjustment for several factors, blood cadmium was the only major determinant of the FRS in men (beta=1.40, 95%CI: 0.96 ~ 1.85, $p < 0.001$), while 3 metals were not associated with the Framingham Risk Score in women. Conclusions: Sex differences exist regarding circulating levels of metals. Cadmium levels were significantly higher in males, while cadmium, lead, and mercury levels were not significantly in females. There are associations between metals and the 10-year risk of coronary heart disease, with cadmium levels being the most important for males in this population.

Abstract Number	**P-3-18-11**
Presenter	Marcela Tamayo y Ortiz*, Rosalind Wright, Martha Maria Tellez-Rojo Solis, Brent A. Coull, Robert O. Wright
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Increased Prenatal Lead Exposure is Associated with Disruption of Infant Daytime Cortisol Production in a Prospective Birth Cohort Study

< Background: Animal studies link increased prenatal lead exposure (PPb) with alterations in the hormonal response to stress in offspring, while human data are sparse. No human study has examined associations between PPb exposure and basal functioning of the hypothalamic-pituitary-adrenal (HPA) axis in infancy. Aims: To examine the association between PPb exposure and daily salivary cortisol profiles, an index of HPA axis function, in infants at age 12 months. Methods: Data are from an ongoing Mexican birth cohort. PPb was measured in maternal blood in the second (Pb2t) and third trimester (Pb3t), and at birth (Pb00). Cortisol was measured in infant daytime saliva collected over two days, after wake up (T1), mid-morning (T2), mid-afternoon (T3) and before bedtime (T4). The average of each time point was used in the analyses. PPb and cortisol measures were logtransformed. Using linear mixed models, we examined associations between PPb exposure indicators (Pb2t, Pb3t, Pb00 and Pb averaged over these three) fit in separate models and salivary cortisol levels at each time point (T1-T4). Models were adjusted for maternal age, education, prenatal stress, gestational age and child's gender. Results: A significant association between increased PPb and reduced cortisol production at T1 and T3 was found – e.g., in the model with average PPb (n=160), effect estimates were b=-0.18 (C.I. -0.33, -0.03) for T1 and b=-0.23 (C.I. -0.4, -0.05) for T3. Results were similar across all PPb indices. Conclusions: These data are first to show an association between increased prenatal lead exposure and altered daytime cortisol production in infants. These findings may provide insight into programming effects of PPb on child development as altered cortisol production may impact children's cognitive and behavioral functioning.

Abstract Number	**P-3-18-12**
Presenter	Rebecca Tutino*, Rachel Grashow, Niladri Basu, Lourdes Schnaas, Karen E. Peterson, Mauricio Hernández-Avila, Martha Maria Tellez-Rojo Solis, Howard Hu, Marc G Weisskopf
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cohort study

Methylmercury Exposure and Acoustic Startle Response in Adolescents: An Exploratory Study

Background The acoustic startle response (ASR) is a reflex mediated by well-described neural processes. The ASR is modified under different behavioral conditions (e.g. during attention tasks). This can be impaired in behavioral disorders, such as attention deficit disorder. Although extensively studied in animal models and some human clinical conditions, few studies have explored the use of the ASR to assess neurological effects of toxicants, and none in adolescents. Aims To describe the relationship between basic ASR amplitude, sociodemographic characteristics typically used in neurodevelopmental studies, and concurrent methylmercury (MeHg) exposure in a cohort of adolescents. Methods We report on recordings from 232 adolescents aged 8-17 years from the Early Life Exposure in Mexico to Environmental Toxicants (ELEMENT) study. The responses to 12 acoustic startle probes (50ms white noise bursts at ~100dB) per subject were recorded as electromyographic (EMG) activity of the eyeblink muscle. Multivariable linear regression was used to evaluate the association between concurrent MeHg exposure and demographic variables and the amplitude of the EMG activity in response to the acoustic probes (the ASR). Results Participants had a mean (SD) ASR amplitude of 1.67µV (2.09). The ASR showed expected habituation. Subject's age, maternal age at birth, socioeconomic status, mother's education, parent marital status, and smoking during pregnancy were not associated with log-transformed ASR amplitude. Sex of the child was associated with ASR amplitude: boys showed a 1.55µV (95% CI: 1.18, 2.03) smaller response than girls. Concurrent mean blood Hg concentration was 2.06 (2.22) µg/L and was not associated with ASR magnitude. Conclusions Sex was strongly associated with ASR magnitude and will have to be carefully considered in future analyses. While concurrent blood Hg was not associated with ASR in the current analyses, we are continuing to increase our sample size, explore other mercury biomarkers, exposure windows, age ranges, and related neurological measures.

Abstract Number	**P-3-18-13**
Presenter	Elena Colicino*, Melinda Power, David Cox, Marc G Weisskopf, Stacey Alexeeff, Pantel S. Vokonas, Avron Spiro III, Joel D. Schwartz, Andrea A Baccarelli
Exposure	ambient air pollution
Health domains	neurodegeneration
Type of research	cross-sectional study

Mitochondrial Haplogroup Clusters Modify the Effects of Black Carbon Exposure on Age Related Cognitive Impairment.

Background: Recent observational studies have linked traffic-related air pollution to loss of cognitive function in the elderly, an effect potentially mediated by oxidative-stress actions on the brain. Mitochondria are the main cellular source of oxidative stress. Haplogroups in mitochondrial DNA (mtDNA) determine between-subject differences in oxidative potential and have been linked with neurodegerative disease. No study has yet investigated whether mtDNA haplogroups influence susceptibility to pro-oxidant exposures, including traffic-related pollution. Aims: To investigate whether mtDNA haplogroups determine differential susceptibility to the effects of long-term exposure to black carbon (BC), a marker of traffic-related air pollution, on cognitive function in older men. Methods: A cohort of 616 men (mean±SD, 71±7 years of age) with an average 1.8 visits (from 1 to 4) per participant between 1996-2007 was drawn from the VA Normative Aging Study. We focused on low (≤25) Mini Mental State Examination (MMSE) score as proxy of impaired cognition in multiple domains. We fitted repeated-measure logistic regression using BC estimated at participant's address in the year before the first visit through a validated spatio-temporal land-use regression model. Results: In models adjusted for clinical features and socio-economics factors, each doubling in BC was associated with 1.2 (95%CI 0.9-1.5) times higher odds of low MMSE score. BC effect on MMSE differed by haplogroup, with most of the effect found in carriers of haplogroups I (OR=3.4; 95%CI 0.8-13.7) or X (OR=2.3; 95%CI 0.9-5.5). Carriers of haplotypes J, T, H V, K, U and W did not show any effect from BC. Conclusions: Susceptibility to the adverse cognitive effects of BC was limited to carriers of mtDNA haplogroups I and X. mtDNA haplogroups may represent a novel susceptibility factor that, due to the central role of oxidative stress in mediating air pollution risks, may also modify effects on other systems.

Abstract Number	**P-3-18-14**
Presenter	Barbara Le Bot, Jean-Paul Lucas, Francoise Lacroix, Philippe Glorennec*
Exposure	metals
Health domains	neurodevelopment
Type of research	exposure measurement

Population-based metals concentrations in tap water consumed by young children in France.

Background. Nested in a national lead biomonitoring cross sectional survey among children aged from 6 months to 6 years, a nationwide housing survey (n=484) has been implemented in France (excluding overseas) in 2008-2009. It was an opportunity to study tap water exposure. Aim. To assess As, B, Ba, Cd, Cr, Cu, Ni, Pb, Sb, Se, U concentrations in tap water consumed by children aged 6 months to 6 years. Methods. Parents were asked for children's tap water consumption or not. 2L of cold tap water were sampled in kitchen, after flushing and 30 min stagnation time. Metals and metalloids were analysed with an inductively-coupled plasma mass spectrometer (ICP-MS). Sampling design and sampling weights were taken into account to estimate their water concentrations for the population of the French children (6 months-6 years) drinking tap water (N = 4,923,058). Results. 274 children out of 484 were drinking tap water, representing 2,977,123 children in the population. Median and 95th percentiles of concentrations (µg/L) in water they drank were respectively: As: 0.2, 2.8; B: <100, <100; Ba: 31, 166; Cd: <0.5, <0.5; Cr: <5, <5 ; Cu: 70,720; Ni: <2, 7.9; Pb: <1, 7; Sb: <0.5, <0.5; Se: <1, 3; U: <0.5, 1.7. Among the 2,977,123 French young children drinking tap water, some of them were drinking water with concentrations above the 2011 World health organization drinking water guidelines: respectively 2000 (CI95%: 0- 6100) over 70 µg/L of Ni, and 78,500 (17,200-140,000) over 10 µg/L of Pb. Conclusion. These tap water metal concentrations estimated for the population of French young children drinking tap water can be used jointly with diet and dust and soil exposure data in an integrated metal exposure assessment.

Abstract Number	**P-3-18-15**
Presenter	Fang-Ying Shen*, Hua-Fang Liao, Wu-Shiun Hsieh, Pau-Chung Chen
Exposure	metals
Health domains	neurobehavioral effects
Type of research	cohort study

Prenatal exposure to lead and manganese on temperament performance in early childhood

Background: The lead and manganese are the common neurotoxic metals in the environment. Coexposure to lead and manganese could injure child neurodevelopment. It was known that lead is associated with child temperament. However, it is not clear that association between prenatal exposure to lead, manganese and temperament performance in early childhood. Aims: The purpose of this study is to understand the effect of lead and manganese exposure in pregnancy of child temperament. Methods: A total of 218 newborns from the Taiwan Birth Panel Study (TBPS) were followed up in northern Taiwan. We collected their cord blood for measuring lead and manganese levels by anAgilent 7500C ICP-MS. We used the Chinese Toddler Temperament Scale which was collected from parental reports for measuring temperament at infants and toddlers. We examined the association between lead and manganese coexposure and child temperament by multiple linear and logistic regression models. Result: We found that lead and manganese level in cord blood was negatively associated with the quality of mood at the age of 4 months [β (SE): 0.153(0.072); p-value: 0.034] and 2 years [β (SE): 0.179(0.075); p-value: 0.018]. We also found that the coexposure of lead and manganese was negatively associated with activity level [β (SE): -0.014(0.006); p-value: 0.028]. There was a significantly higher risk [odds ratio: 3.18; 95% confidence interval (CI):1.09-9.25] of having difficult type at the age of 2 years in the high manganese exposure group. Conclusions: Lead and manganese exposure during pregnancy may have an adverse effect on early child temperament performance. Mechanistic studies are needed to elucidate the causal relationship. Key words: temperament, lead, manganese, early childhood

Abstract Number	**P-3-18-16**
Presenter	Harley Davis, C. Marjorie Aelion, Suzanne McDermott*
Exposure	metals
Health domains	equity
Type of research	cross-sectional study

Racial disparities in the potential for exposure to arsenic and lead in soils for a Medicaid population of mothers in South Carolina, USA

Background Maternal exposure to environmental arsenic (As) and lead (Pb) has been associated with numerous negative health outcomes in the fetus. Disparities in exposure to these metals, specifically between non-Hispanic black and non-Hispanic white individuals have also been documented in the USA. Aims Our aim was to examine the racial disparity of potential exposure to both As and Pb in soils in South Carolina (SC), USA, in a population of mothers enrolled in SC Medicaid, controlling for both distal (average per-year emissions of these metals from facilities) and proximal (road coverage and home age) sources. Methods The study population consisted of a cohort of mothers giving birth in SC while enrolled in Medicaid from 1996-2001 (n=8,666). Soil As and Pb concentrations were measured (in mg/kg) in SC, and kriged at the mother's geocoded address. Demographics were obtained from SC birth certificates and US Census 2000 data at the block group level. Block group area covered by roads (%), and average per-year on site releases of As and Pb within block groups, and at varying distances, were calculated. Multilevel models were used with As and Pb as separate outcomes. Results After controlling for demographics and sources, there was a significant racial disparity between black and white mothers for both As and Pb. This disparity was greater for Pb (β = 2.78, p<0.0001) than for As (β = 0.079, p=0.04). Facilities emissions were not significant predictors of soil As and Pb, but a higher percentage of roads was significantly associated with higher As and Pb concentrations. Conclusions We identified significant racial disparities for potential exposure to both As and Pb in soils in a Medicaid population of mothers, suggesting black mothers are more likely to live where soil As and Pb concentrations are higher. Distal sources were not as important to As and Pb soil concentrations as proximal sources, potentially due to the low number of facilities or quantity of emissions.

Abstract Number	**P-3-18-17**
Presenter	Anne Etchevers*, Alain Le Tertre, Philippe Glorennec
Exposure	metals
Health domains	neurodevelopment
Type of research	cross-sectional study

THE CONTRIBUTION OF RESIDENTIAL EXPOSURES TO CHILDREN'S BLOOD LEAD LEVELS IN FRANCE: RESULTS FOR DIFFERENT BLOOD LEAD LEVELS

Background: The geometric mean (GM) of Blood Lead Levels (BLLs) decreased from 36 to 15µg/L between 1996 and 2009 in 1 to 6 years old children in France. However, regarding accumulating scientific evidence of adverse effects of BLLs at low levels in children, it is important to update exposure assessment at current BLLs. Aim: To estimate the effects of environmental determinants for different BLLs in children in France. Methods: A national cross-sectional survey, conducted in 2008-2009, enrolled 484 French children aged from 6 months to 6 years. We collected data on social, housing and individual characteristics. Lead concentrations in blood and environmental samples (water, soils, home dusts, paints and other unusual sources such as cosmetics and traditional dishes) were measured using Inductively Coupled Plasma Mass Spectrometry. Two different statistical models were performed: a multivariate generalized additive model to evaluate the association between the GM of BLLs and environmental risk factors and a quantile regression model on the 90th percentile of BLLs to identify risk factors of highly exposed children. Both models took into account the sampling design. Results: The geometric mean of BLLs was 13.8 µg/L (95% Confidence Intervals (CI): 12.7-14.9) and the percentile 90 was 26.8 µg/L (CI: 24.2-26.8). There was an association between BLLs (GM) and tap water lead (when concentrations were ≥ quantile 99), outdoor dust on the playground (when concentrations were ≥ quantile 95), indoor dust (when concentrations were ≥ quantile 95), dust in common area (when concentrations were ≥ quantile 99) and family use of traditional leaded ceramics. The results of on-going analyses on 90th percentile of BLL will be displayed as well. The estimates were adjusted on sex, age, passive smoking, lead concentrations in paint, parents occupational at risk and use of leaded cosmetics. Conclusions: Tap water, soil and indoor dust are still responsible for increasing BLL, even at low BLLs.

Abstract Number	**P-3-18-18**
Presenter	Jinliang Zhang*, Libo Pan, Bing Wang, Ling Liu
Exposure	metals
Health domains	mental health
Type of research	meta-analysis

The Impact of Lead-acid Battery Manufacturers on the Environment and Human Lead Burden

Aim: In order to understand the impact of lead-acid battery manufacturers on the environmental and the human health, we viewed and summarized lead level in the workplace of lead-acid battery manufacturers and surrounding environment, as well as the burden of lead in workers and nearby children. Methods: Through the dataset of CNKI, Science Direct database, PUBMED and Google Scholar we searched published articles reported the survey on the lead-acid battery manufacturers from 1990 to 2011. Finally, 45 articles were selected, which covered 34 battery manufacturers from 34 cities in 15 provinces, China. Results: The range of reported average lead dust and lead fume in the workplace were 0.032～2.880 mg/m3 and 0.027～0.710 mg/m3, respectively, which exceeded national standard limitation with proportion of 0.0～100.0% and 25.0～95.6%. The reported average blood lead level (BLL) and urinary lead level of workers were 138.0～869.4µg/L and 0.28～1.24µmol/L. Of them, 0.0～100.0% and 4.8～74.4% were reported higher than the occupational exposure limits. The lead levels in the atmosphere, surface water and soil around the lead-acid battery manufacturers were 0.0004～1420.0mg/ m3, 0.003～29.925mg/L and 0.05～2980.00 mg/kg, respectively. The average BLLs of children nearby lead-acid battery manufacturers were 91.20～531.68µg/L, the percentage of elevated blood lead level was 8.9%～97.1%. Conclusion: There were series lead pollution in the workplace of lead-acid battery factories, China. The burden of lead for workers is higher, too. The surroundings nearby the battery factory have been contaminated by lead as well. The BLLs of children living around the battery factory was higher than those living in urban or rural districts without lead-emission industrious enterprise. Funded by the National Basic Research Program (973) of China (NO.2012CB525005) and the CRAES Basic Scientific R & D Business Special for the Central Nonprofit Research Institutes (NO. 2009KYYW19)

Abstract Number	**P-3-18-19**
Presenter	Rudolph P. Rull*, Alison J Canchola, Peggy Reynolds, Pamela L Horn-Ross
Exposure	metals
Health domains	reproductive outcomes
Type of research	cohort study

Urinary cadmium and the timing of pubertal development in girls

BACKGROUND Cadmium is a reproductive toxin and carcinogen that exhibits estrogen-like activity. In addition to smoking, exposure to cadmium occurs from inhalation of polluted air and diet. Little is known about whether exposure to cadmium affects pubertal development in girls. AIMS Our aim was to determine whether urinary cadmium concentration was associated with the attainment of menarche and Tanner's stages of estrogenic (breast) and androgenic (pubic hair) development. METHODS A total of 211 girls between the ages of 10 and 13 years and primarily non-Hispanic white or Chinese provided an overnight urine specimen and completed an interview and self-assessment of Tanner's stage of breast and pubic hair development at baseline and annually for up to two years. Attainment of menarche was assessed monthly. Urinary cadmium and creatinine concentrations were measured using inductively coupled plasma mass spectrometry and a modified-rate Jaffe method, respectively. Cox proportional hazards regression was used to evaluate whether cadmium was associated with age at menarche and cumulative logit regression to evaluate whether cadmium was associated with stage of breast and pubic hair development. RESULTS The mean creatinine-adjusted cadmium concentration was 0.24 µg/g (SD=0.12 µg/g); it was highest among 10-year olds (0.29 µg/g creatinine) and decreased with age (mean among 13-year olds=0.23 µg/g; Kruskal-Wallis p=0.05). Chinese girls had higher cadmium levels than non-Hispanic white girls (0.30 vs. 0.23 µg/g; p=0.006). Girls with the highest unadjusted cadmium concentrations (≥ 0.4 vs. <0.2 µg/L) were less likely to have attained menarche (hazard ratio=0.42; 95% confidence interval=0.23-0.78; p-trend=0.007). They also had a lower Tanner stage of pubic hair growth (odds ratio=0.24; 95% confidence interval=0.07-0.81). Breast development stage was not associated with cadmium concentration. CONCLUSIONS These findings suggest that cadmium exposure may delay pubertal development in girls.

Abstract Number	**P-3-18-20**
Presenter	Paloma Beamer*, Anastasia Sugeng, David Layton, Miranda Loh
Exposure	metals
Health domains	no health domain
Type of research	exposure measurement

Use of dust fall filters as passive samplers for metal concentrations in air

Background: Mine tailings are a source of metal exposures in many rural communities. Simple low-cost methods are needed to characterize the spatial variability of metals present in the air near these sites and exposures to nearby residents. Aims: The objective of our study was to assess if dust fall filters can serve as passive air samplers and understand which factors may affect the estimated flow rates. Methods: We placed 120 mm filters in stainless steel cylinders (H=190 mm) along with active indoor air samplers in the same room for 7 days in 10 occupied homes in a rural area near Tucson, Arizona. In addition to measuring the bulk mass of particulates, both sets of filters were analyzed for metal concentration via ICP-MS following nitric acid microwave digestion. We calculated an estimated flow rate by dividing the total mass on each dust fall filter by the bulk air concentration measured in each house and the sampling duration. We used tree analysis to identify meteorological factors that have the strongest impact on flow rates. The estimated flow rate was used to estimate metal concentration in air. Results: The mean flow rate for dust fall filters was 0.096±0.033 m3/hr during weeks with no precipitation, which was significantly different (p=0.005) than the mean flow rate when there was precipitation during the week (0.88±0.30 m3/hr). The estimated air concentration had a significant linear association with the measured air concentrations for manganese and arsenic (p<0.005), but not for nickel, cadmium and lead. The primary source of manganese and arsenic in indoor air in this community is re-suspended soil from outdoors, while the other metals are likely to have additional indoor sources with smaller particle sizes. Conclusions: Our results indicate that dust fall filters could be useful to measure concentrations of metals from re-suspended soil, but further work is needed to determine if they can be used to assess metal concentrations from other sources.

Abstract Number	**P-3-21-01**
Presenter	Ieva Malinauskaite*, Rimvydas Slapikas, Jone Vencloviene
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

ATMOSPHERIC, COSMIC, SOLAR VARIATIONS AND HOSPITALIZATION FOR CARDIOVASCULAR DISEASES

Background. Recent investigations have shown that hospitalizations for cardiovascular diseases might be associated with environmental factors. Aim. To evaluate the associations between seasonal, meteorological, heliophysical factors and the risk of hospitalizations due to acute myocardial infarction (AMI) and stroke. Methods. The study comprised 1115 patients with AMI and 801 patients with stroke hospitalized in Lithuanian University of Health Sciences Cardiology and Neurology Clinics in the year 2010. National Geophysical Data Centre data was used to evaluate solar activity, geomagnetic activity and cosmic radiation activity. Kaunas Meteorological station data was used to evaluate meteorological conditions. SPSS 15.0 for Windows was used in the statistical analysis. Results. The mean of hospitalized patients with AMI per day in June and July was 2.40±0.18, in other months 3.18±0.18, p=0.004. When a day before hospitalization wind speed was ≤ 1.3 m/s, AMI mean was 3.06±0.179. When wind speed was ≥2.7 m/s, AMI mean was 3.17±0.19. When atmosphere pressure a day before hospitalization was lower than 995 mmHg, AMI relative risk was RR=1.23, 95% CI 1.08-1.41. When relative humidity a day before hospitalization was lower than 88%, AMI relative risk RR=1.18, 95% CI 1.03-1.34. When geomagnetic index Ap≥16, AMI and stroke means were higher than when Ap<16. When geomagnetic activity was low (Ap<4) and cosmic ray activity was high (≥9500 imp/min), AMI mean was 3.7. When geomagnetic activity was low (Ap<4) and cosmic radiation activity was lower than 9500 imp/min, AMI mean was 2.88, p<0.05. Conclusions. In summer AMI frequency was lower than in other seasons. There were tendencies for stroke risk to be higher when geomagnetic activity was high. AMI risk was associated with wind speed, atmosphere pressure, relative humidity, geomagnetic activity and cosmic radiation activity.

Abstract Number	**P-3-21-02**
Presenter	Gina Torres Monteiro*, Adalberto Luiz Miranda-Filho
Exposure	no exposure
Health domains	cancer
Type of research	others

Brain Cancer Incidence and Mortality: Differences in Geographic Region and Human Development Index

Background: Brain cancer etiology is poorly understood. Geographic differences in its incidence and mortality rates suggest the presence of environmental risk factors. Aims: To evaluate the differences in brain cancer incidence and mortality magnitude, by continents and human development indexes. Methods: This descriptive study compared the incidence and mortality rates according to the human development classification (HDI = low, medium, high or very high) and geographic distribution (Africa, Asia, Central America, North America, South America, Europe and Oceania). Data were collected from Globocan 2008. Results: The countries with the highest HDI presented the highest brain cancer incidence and mortality rates. The incidence was noticeable for difference in the adjusted rates magnitude: being the highest observed in the northern hemisphere (North America = 5.6 and Europe = 5.4/100,000 inhabitants) and the lowest in Africa (1.4/100,000 inhabitants). The mortality rates also presented differences in the studied regions. The highest ones were in Europe, Oceania, South America and North America (between 3.0 and 3.8/100,000 inhabitants), followed by Central America and Asia (2.4 and 2.3/100,000 inhabitants) and Africa (1.1/100,000 inhabitants). Both the incidence and the mortality rates were higher for the male gender in all regions. Conclusions: Differences in brain cancer geographic distribution that may be related to environmental risk factors were identified. Such results instigate that researches should be proposed to elucidate such factors.

Abstract Number	**P-3-21-03**
Presenter	Tsun-Jen Cheng*, Yi-Ping Lin, Mei-Chih Tseng
Exposure	electromagnetic fields
Health domains	other
Type of research	cross-sectional study

Factors associated with health risk perception for electromagnetic fields in Taiwan

Factors associated with health risk perception for electromagnetic fields in Taiwan Mei-Chih Meg Tseng1, 2, Yi-Ping Lin 3, Tsun-Jen Cheng2* 1Department of Psychiatry, National Taiwan University Hospital, Taipei, Taiwan and National Taiwan University College of Medicine, Taipei, Taiwan.; 2Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University, Taipei, Taiwan; 3Institute of Science, Technology, and Society, School of Humanities and Social Sciences, National Yang Ming University, Taipei, Taiwan, Backgrounds: Health risk perception for electromagnetic fields (EMFs) and the associated factors have been previously reported in Taiwan. Recently, psychological conditions were reported to be associated with the hypersensitivity to electromagnetic field. Aims: We investigated the perceived risks of EMFs and other environmental agents in the general population. Subsequently, the factors associated with the risk perception including psychopathology were investigated. Methods: A total of 1251 adults selected from a nationwide telephone interviewing system database responded to a telephone survey. The interview consisted of questions regarding demographic variables, presence of catastrophic illness, perceived health risks of various environmental agents. Questions assessing participants' psychiatric conditions (Brief Symptom Rating Scale-5) and the degree of sensitivity to EMFs were also included. Results: More than half of the survey respondents considered power lines and mobile phone base stations to affect people's health to a big extent. Higher sensitivity to EMFs, psychopathology, being female, being married, more years of education, and having a catastrophic illness had positive associations with perceived risks of EMF-related environmental sources as well as for all environmental sources combined. Conclusions: Psychopathology may influence on general people's risk perception for electromagnetic fields.

Abstract Number	**P-3-21-04**
Presenter	Anna Schöni*, Katharina Roser, Martin Röösli
Exposure	electromagnetic fields
Health domains	other
Type of research	cohort study

How do Swiss adolescents use their mobile phones?

Background: The ongoing HERMES study aims to investigate whether the exposure to radiofrequency electromagnetic fields (RF-EMF) emitted by mobile phones or the use of mobile phones itself affects cognitive functions or causes behavioural problems and non-specific health disturbances in adolescents. Calls on the UMTS (Universal Mobile Telecommunications System) network cause on average 100-500 times less exposure than calls on the GSM (Global System for Mobile Communications) network. This difference in exposure will allow, in principle, to derive an exposure metric which does not only depend on usage duration. Aims: Analysis of mobile phone usage behaviour of adolescents using objective mobile phone traffic data provided by the mobile phone operators including information on the network being used. Methods: Detailed mobile phone traffic data for 175 7th and 8th grade students was provided from two mobile phone operators. On average data has been recorded over a period of 8.1 months per participant. Results: Preliminary results showed a call frequency of 24.8 times per month with an overall call duration of 81.0 minutes per month. The total number of SMS used per month added up to 174. The duration of data transfer amounted to 140.6 hours per month. 51 participants used mainly the UMTS network to talk on the phone (>75% on UMTS), whereas 41 participants used mainly the GSM network (<25% on UMTS) and 83 participants used both networks (25-75% on UMTS). Conclusions: There are considerable interindividual differences in the network being used for talking on the phone. This will enable us to derive an exposure metric which does not depend on the duration of use only and may be suitable to differentiate between radiation and mobile phone training effects. Since data transfer is by far the most common type of using mobile phones in today's Swiss adolescents, it has to be taken into account in analyses because it is expected to substantially contribute to the whole-body exposure.

Abstract Number	**P-3-21-05**
Presenter	Michelle Turner*, Elisabeth Cardis, and the INTEROCC Study Group
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

Interactions between occupational exposure to extremely low frequency magnetic fields and chemicals for brain tumor risk in the INTEROCC study

Background: Brain tumors are a serious, often fatal disease with few established risk factors. Although ionizing radiation has been clearly linked with brain tumors, there are a number of other environmental and occupational possible risk factors. There may also be interactions between occupational chemical and physical agents for brain tumors however the past epidemiological literature has been sparse. One previous epidemiological study examined potential interactive effects between occupational exposure to extremely low frequency magnetic fields (ELF-MF) and chemical agents with various interactive effects observed. Aims: The aim of this paper was to examine the possible joint effects of occupational agents for brain tumors including occupational ELF-MF and chemicals in the large-scale INTEROCC study. Methods: INTEROCC includes seven participating countries (Australia, Canada, France, Germany, Israel, New Zealand, United Kingdom) from the parent INTERPHONE study. Cases of primary brain glioma and meningioma aged at least 20 years were recruited between 2000 and 2004. Detailed occupational history data was collected for jobs held for at least six months. Job titles were coded into standard international occupational classifications and estimates of ELF-MF and chemical exposure were assigned based on job exposure matrices. Odds ratios (and 95% confidence intervals) for single and co-occupational exposures were calculated according to a common reference category. Results: Data on a total of 3,978 brain tumor cases, including 2,054 gliomas and 1,924 meningiomas, were analyzed with 5,601 control subjects. A number of interactions between ELF-MF and chemicals, particularly metals, were observed for glioma. Possible methodological factors underlying findings are explored. Conclusions: Further research examining possible joint effects of occupational agents for brain tumors with refined assessments of occupational exposure in other large-scale studies is warranted.

Abstract Number	**P-3-21-06**
Presenter	Mateus Habermann*, Nelson Gouveia
Exposure	electromagnetic fields
Health domains	reproductive outcomes
Type of research	case-control study

Low birth weight and exposure to magnetic fields in São Paulo/Brazil.

Background: Potential effects of exposure to magnetic fields on human health have worried the population and policy makers worldwide. Magnetic fields (MF) have been associated with several outcomes such as cancer, leukemia, amyotrophic lateral sclerosis, cardiovascular diseases and birth outcomes. Aims: To evaluate the association between low birth weight (LBW) and maternal exposure during pregnancy to MF from transmission lines (TL) in the city of São Paulo, Brazil. Methods: Analysis included 5,772 cases of term-LBW (<2,500 g) and 5,814 controls matched by sex and month of birth. The subjects were selected from the birth registration system and mothers' addresses were geocoded to estimate exposure to MF according the distance to nearest TL. Three regression models were developed: TL of all voltage, TL≤200 kV and >200 kV. The final models were evaluated using multiple logistic regression adjusting for birth, maternal and pregnancy characteristics. Results: The analysis did not indicate association between proximity to TL and LBW. In the multivariate analysis mothers residing 100-200 m from TL exhibited OR 1.06 (95% IC 0.85; 1.33) in relation to mothers ≥400 m (reference group). The analysis with TL≤200 kV and >200 kV did not alter the results. We did not observe a linear trend of risk. Moreover mothers with less income and low education resided nearest to the TL. Conclusions: We did not find association between maternal residential distance to TL and LBW. The results suggest no relation between occurrence of LBW and MF exposure.

Abstract Number	**P-3-21-07**
Presenter	Chelsea Eastman*, Elisabeth Cardis, Siegal Sadetzki, Roel Vermeulen, Myron Maslanyj, Katja Radon
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

MOBI-Kids: assessing childhood and adolescent exposure to communication technologies and risk of brain tumours

Background: Rapidly increasing mobile phone use in young people has generated concern about possible health effects of exposure to radiofrequency (RF) fields. Aims: MOBI-Kids, a multinational case-control project, studies potential effects of childhood and adolescent exposure to electromagnetic fields from mobile communications technology on brain tumour risk. Methods: Australia, Austria, Canada, France, Germany, Greece, India, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Spain, and Taiwan follow a common protocol, and aim to recruit about 2,000 brain tumour cases and 4,000 controls aged 10 to 24 years. Controls are hospital-based to reduce potential selection bias related to low participation among population-based controls. Detailed information is collected on potential risk factors, including: mobile phone use; residential, occupational, and medical history; exposure to environmental agents; and parental occupations and maternal exposures in utero and early childhood. To increase the validity of mobile phone exposure estimates and to characterise possible recall errors to be accounted for in the main analyses, self-reported phone use is compared to operator records and to a smartphone application recording use. Developing indices of exposure to RF and extremely low frequency fields from mobile phones and environmental and occupational sources is underway. Biological samples are collected to contribute to future international consortia to study the genetics in the aetiology of this rare disease. Results: By the end of 2012, 357 brain tumour cases and 583 controls had been interviewed. Approximately 83% and 60% of identified cases and controls, respectively, agreed to participate. The average age was 18.8 years and 57% were male. 85% of controls reported making, on average, one voice call per week for at least three months. Conclusions: Though setting up MOBI-Kids has been logistically challenging, preliminary results indicate it is a feasible and relevant study for this age group, particularly when considering the high reported mobile phone use.

Abstract Number	**P-3-21-09**
Presenter	Michelle Turner*, Geza Benke, Joe Bowman, Jordi Figuerola, Elisabeth Cardis, and the INTEROCC Study Group
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

Occupational exposure to extremely low frequency magnetic fields and brain tumors in the INTEROCC study

Background: Brain tumors are a serious, often fatal disease with few established risk factors. Although ionizing radiation has been clearly linked with brain tumors, there are a number of other environmental and occupational agents suspected including extremely low frequency magnetic field (ELF-MF) exposure. However the literature is inconsistent, and questions remain due to small numbers and limitations in exposure assessment in previous studies. Aims: The aim of this paper was to examine the association between occupational exposure to ELF-MF in different time windows and brain tumors in the large-scale INTEROCC study. Methods: INTEROCC is formed by seven participating countries (Australia, Canada, France, Germany, Israel, New Zealand, United Kingdom) from the parent INTERPHONE study. Cases of primary brain glioma and meningioma aged at least 20 years were recruited between 2000 and 2004. Detailed occupational history data was collected for jobs held at least six months. Job titles were coded into standard international occupational classifications and estimates of mean workday ELF-MF exposure assigned based on a job exposure matrix. Conditional logistic regression was used to obtain adjusted odds ratios (OR) and 95% confidence intervals (CI). Results: Data on a total of 3,978 brain tumor cases, including 2,054 gliomas and 1,924 meningiomas, were analyzed with 5,601 control subjects. Estimates of cumulative exposure, time-weighted average exposure, maximum exposure, and exposure duration were calculated 1-4, 5-9, and 10+ years in the past. Positive associations between different indicators of ELF-MF exposure 1-4 years prior to the date of diagnosis/reference date and glioma were observed (OR > 90th percentile cumulative exposure = 1.85, 95% CI 1.50-2.28, $p < 0.0001$ linear trend). Conclusions: Occupational ELF-MF exposure may play a role in the promotion of glioma, however findings may also be due to methodological sources of bias.

Abstract Number	**P-3-21-10**
Presenter	Anke Huss*, Adrian Spoerri, Matthias Egger, Hans Kromhout, Roel Vermeulen
Exposure	electromagnetic fields
Health domains	neurodegeneration
Type of research	cohort study

Occupational exposure to magnetic fields and electric shocks and risk of ALS – analysis of the Swiss National Cohort

Background Previous studies have identified increased risks of amyotrophic lateral sclerosis (ALS) in electrical workers, but studies assessing risk in workers exposed to magnetic fields were ambiguous. Electric shocks have been hypothesised to be the relevant exposure, but potential risks from electric shocks have not been previously disentangled from those of magnetic fields. We aimed at analysing the association of ALS with both magnetic field exposure as well as risk of electric shocks at work. Methods We used the Swiss National Cohort study, which is based on census information from 1990 and 2000 linked with mortality records from 2000-2008. High or medium versus low exposure to magnetic fields and risk of electric shocks was assigned to occupations using two job exposure matrices. Data of 4.7 million persons were analysed using Cox proportional hazard models and adjusted for age, sex, educational level, civil status, nationality, language region, degree of urbanity of the municipality and an area-based proxy for socioeconomic position. Results During 2000-2008, 1313 persons with information on occupation died from ALS. Hazard ratios were around unity for persons exposed to magnetic fields or risk of electric shocks in either 1990 or 2000. In persons classified as medium or high exposed in both 1990 and 2000, a slight increase in mortality from ALS was observed for magnetic field exposures (HR 1.39, 95% CI 1.03-1.87), but less so for electric shocks (HR 1.20, 95%CI 0.88-1.65). When accounting for both exposures in the same model, magnetic fields had a similar HR (1.36, 95%CI 0.99-1.89) as before, but the HR for electric shocks was attenuated to 1.07 (95%CI 0.76-1.5). Conclusions We observed an association of long-term exposure to extremely low frequency magnetic fields and mortality from ALS, but not of risk of electric shocks and ALS.

Abstract Number	**P-3-21-11**
Presenter	Anne Grundy*, Shelley A Harris, Paul A Demers, Kenneth C Johnson, David A Agnew, Paul J Villeneuve
Exposure	electromagnetic fields
Health domains	cancer
Type of research	case-control study

Occupational Magnetic Field Exposure and Male Breast Cancer Among Canadian Men

Background: Occupational magnetic field (MF) exposure has been suggested as a male breast cancer risk factor, but due to the rarity of this disease, many epidemiologic studies investigating the relationship have been underpowered. As well, exploring this relationship in men provides an opportunity to overcome the potentially confounding influence of reproductive factors on this association in women. Aims: This study investigated associations of several characterizations of occupational MF exposure with male breast cancer using data from the population-based case-control component of the Canadian National Enhanced Cancer Surveillance System. Methods: Job histories were obtained for 115 cases and 570 controls. Using blinded expert review of each job, the average MF exposure of individual jobs was coded into three categories: <0.3, 0.3-<0.6 or ≥0.6 μT. The impact of ever and cumulative MF exposure, as well as exposure duration and specific exposure-time windows, on cancer risk was examined using logistic regression adjusted for age, education, income, marital status, BMI and physical activity. Results: The proportion of cases (28%) who were ever exposed to ≥0.3 μT was higher than among controls (22%) and an elevated, though not statistically significant, risk of breast cancer was seen in men ever exposed to ≥0.6 μT (OR=1.81, 95%CI=0.81-4.03). Unadjusted analysis demonstrated a significantly increased risk for men with ≥30 years of occupational MF exposure (OR=4.20, 95%CI=1.52-11.56), though this was attenuated after adjusting for other risk factors (OR=2.44, 95%CI=0.84-7.15). Conclusions: Our analysis, in one of the largest case-control studies of male breast cancer conducted to date, supports the idea that occupational exposure to MF increases breast cancer risk. The relatively wide confidence intervals underscore a research need to pool across multiple study populations to provide further insight into whether exposure to MF increases the risk of breast cancer.

Abstract Number	**P-3-21-12**
Presenter	Seung-Cheol Hong*, Kim Ki-Young, Lee Yoon-Jin, Jeong Yeon-Jun
Exposure	electromagnetic fields
Health domains	healthrelated quality of life
Type of research	exposure measurement

Radio frequency electric fields emission level in infant nursery facilities

Background and Aims The wireless Internet programs as WiFi (Wireless Fidelity) is being used more than ever before. In addition, since the Internet wireless router is now installed even more conveniently, more people have been allowed to benefit from the online services at their own offices and homes. According to the former researches, children would be more exposed to SAR (Specific Absorption Rate) than adults would. In consideration of such finding, the study has looked into 2.4 GHz – 2.483 GHz radio frequency electric fields emission level in infant nursery facilities. Methods The determination on the objects has been made in order of how many WiFi facilities were built around the infant nursery centers. For the electric fields measurement, the fields were measured 1.1m, 1.5m and 1.7m respectively from the central ground inside each facility as the measurement standard of the information and communication standards TTAS.KO-06.0125 was applied in association with SRM-3000 (NARDA, Savona, Italy). Results A total of 20 infant nursery facilities were selected. According to the measurement results, the average value was included to 38.06 ± 1.30 V/m while the maximum value appeared to be 41.24 V/m. After an evaluation was conducted via EI (Exposure Index) which was a square of the ratio of electric fields intensity measurement to human protect standard, the WiFi exposure index was observed to be 0.3894. Conclusions According to what has been acquired in the study, RF-EMF environment within 2.4 GHz – 2.483 GHz radio frequency electric fields in infant nursery facilities was confirmed to be less than 10% in comparison with the human protect standard. Any follow-up studies are suggested to measure 5 GHz field-WiFi which is being released to the market while they make an assessment on multi-frequency exposure.

Abstract Number	**P-3-21-13**
Presenter	Sam Aerts*, Dirk Deschrijver, Luc Martens, Tom Dhaene, Wout Joseph
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure modeling

Sequential measurement method to construct RF-EMF exposure maps

The rapid introduction over the last years and increasing use of wireless technologies nowadays led to public health concerns regarding adverse health effects. The general public, however, is not familiar enough with the typical everyday exposure levels, although they are generally well below reference levels based on scientific evidence and issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). A practical way to fill this information gap is the use of a heat map, which is easily comprehensible for laymen and experts. Although a heat map can be built using non-measurement based estimations or RF-EMF simulators, these approaches are heavily dependent on accurate data (e.g., base station parameters), which is seldom readily available. Our method, however, is solely measurement-based, but instead of the traditional approach of defining a uniform or random measurement grid beforehand, we introduce an iterative strategy, in which measurement locations are based on the information gained from previous measurements, with the specific aim to rapidly discover and characterize regions of elevated exposure (hotspots). This so-called sequential design has proven its worth in many other research domains. Using fast broadband measurements, we applied our method to the city center of Ghent, Belgium (area 1 km2), and built an accurate, graphical representation of the RF-EMF exposure. Analysis of a set of random validation measurements showed excellent results (r = 0.75; average relative error < 3 dB). The average electric-field strength was 0.49 V/m, and maximum levels of 1.7 to 3.1 V/m were measured in the discovered hotspots. Narrowband measurements further identified GSM900 mobile phone base stations as principal contributor (45 to 100%) to the total RF-EMF exposure. Methodologies such as ours, using measururement-based iterative algorithms, are needed to anticipate critical areas and to quickly assess the exposure in a certain area.

Abstract Number	**P-3-21-14**
Presenter	Jone Vencloviene*, Ruta Babarskiene, Irena Milvidaite, Raimondas Kubilius, Jolanta Stasionyte
Exposure	others
Health domains	cardiovascular disease
Type of research	cross-sectional study

The effect of solar-geomagnetic activity during and after hospital admission on coronary events within one year in patients with acute coronary syndromes

Background and Aims: Some evidence has been reported the deterioration of the cardiovascularsystem during space storms. There is evidence indicating that geomagnetic storms are associated with decreased heart rate variability; elevated blood pressure, blood coagulation and platelent aggregation, increased blood viscosity, and decelerated blood flow. It is plausible that the heliophysical conditions during and after hospital admission may affect the risk of coronary events in patients with acute coronary syndromes (ACS) during one-year period. Methods:We analyzed the data of 1,400 ACS patients who were admitted to the Hospital of Lithuanian University of Health Sciences, and who survived for more than 4 days. We evaluated the associations between geomagnetic storms (GS), solar proton events (SPE), and solar flares (SF) that occurred 0-3 days before and after hospital admission and the risk of cardiovascular death (CAD), non-fatal ACS, and CABG during a period of one year; the evaluation was based on the multivariate logistic model, controlling for clinical data. Results: After adjustment for clinical variables, GS occurring in conjunction with SF on day before admission increased the risk of CAD by over 2.5 times (OR=2.55 95% CI 1.04-6.28). GS occurring two days after SPE on second day of admission increased the risk of CAD and CABG by over 2.5 times (respectively, OR=2.86 95% CI 1.05-7.79 and OR=3.77 95% CI 1.41-10.1). The risk of CABG increased by over 2 times in patients admitted during the day of GS and one day after SPE. The risk of ACS was by over 1.63 times higher for patients admitted one day before or after solar flares (OR=1.63 95% CI 1.04-2.55); the effect of SF was higher in patients with the greatest risk. Conclusions: These findings suggest that the heliophysical conditions before and after hospital admission affect the risk of major adverse cardiovascular events during one-year period.

Abstract Number	**P-3-21-15**
Presenter	Johan Beekhuizen*, Hans Kromhout, Alfred Bürgi, Anke Huss, Roel Vermeulen
Exposure	electromagnetic fields
Health domains	no health domain
Type of research	exposure modeling

The Impact of Input Data Accuracy on the Validity of Modelled Electromagnetic Fields from Mobile Phone Base Stations

Background The large increase in mobile communication has led to concern about potential health effects of radio frequency electromagnetic fields (RF-EMF) from mobile phone base stations. Different RF-EMF prediction models, with varying availability and quality of input data, have been applied to assess population exposure to RF-EMF. Our study determines the impact of input data accuracy on model validity, as detailed input data is not always available for epidemiological studies. Methods We used NISMap, a 3D geospatial RF-EMF modelling environment, to test models with different levels of available 3D building and antenna data, and with varying building damping parameters and radio-wave propagation algorithms. The outcomes were compared with a large sample of outdoor measurements taken in the city of Amsterdam, the Netherlands. Results The average total measured field strength was 0.34 V/m. Results showed good agreement between modelled and measured electric fields when 3D-building data and basic antenna information (location, height, frequency and direction) were used: The correlations were at least moderate (Spearman R > 0.6), with a precision (the standard deviation of the errors) ranging from 0.17 to 0.19 V/m. The model's performance was not very sensitive to changes in radio wave propagation algorithms and building damping parameters. Including information about antenna down-tilt, type and output power did not significantly improve model performance compared with using average down tilt and power values, or assuming one standard antenna type. Conclusions We conclude that applying a 3D geospatial model is a feasible approach to model outdoor RF-EMF strengths, when 3D building data and information on the antenna height, frequency, location and direction are available.

Abstract Number	**P-3-23-01**
Presenter	Amit Ophir, Isabella Karakis, Elihu D. Richter, Uri Wormser, Michael Aschner, Elyakim Doitsch, Yoram Finkelstein*
Exposure	organic compounds
Health domains	neurobehavioral effects
Type of research	cross-sectional study

ADD/ADHD induced by organophosphorous pesticide drift – A study on more than two generations of exposure

Background: Previous studies (1984-1991) showed reversible in-season neurobehavioral effects of seasonal exposures to organophosphorous (OP) pesticides in a cohort of agricultural workers and residents in rural communities in Northern Israel. Aims: To characterize and assess the prevalence of Attention Deficit/ Hyperactivity Disorder (ADD/ADHD) in: (A) Family members of participants in the original cohort (n=139), 87 (62.5%) of them still living in the same community and continuously subjected to OP exposures. (B) Schoolchildren in the same communities, 8-12 years-old (n=135), 84% of whom are "second generation" of OP exposures, as at least one of their parents has been residing in a rural area for at least three decades. Methods: (A): Adults: interviewed for health problems and prevalence of ADD/ADHD in their families.(B): Schoolchildren: a cross- sectional study in which they were classified into 3 groups by the extent OP exposures (high, low and minimal).Questionnaires on OP exposure, health problems, behavioral patterns and ADD/ADHD were administered to teachers and parents. The distance between homes and fields was studied and correlated with the familial prevalence of ADD/ADHD. Results: (A): Adults: 61 (25%) of 245 siblings of the respondents in the original cohort were diagnosed with ADD/ADHD. (B): Schoolchildren: a gradient between the extent of OP exposure and ADD/ADHD was found (p=0.03). Familial prevalence of ADD/ADHD in the highly-exposed group was higher than in the minimally-exposed group (OR=2.6; 95% CI (0.79-8.53). A higher familial prevalence of ADD/ADHD was noted in children residing < 50 meters from the fields (5/11; 45%), as compared with those residing more distantly from the fields (19/62; 30%). Conclusions: ADD/ADHD prevalence in the study population showed OP-dependent exposure-effect gradient. Furthermore the ADD/ADHD in this population exceeded the reported prevalence (5%-7%) in Israel. We posit that environmental-susceptibility interactions may be mediating risk for ADHD in children with endemic OP exposure.

Abstract Number	**P-3-23-02**
Presenter	Vivien How*, Zailina Hashim, Patimah Ismail, Dzolkhifli Omar
Exposure	pesticides
Health domains	cancer
Type of research	exposure measurement

Assessment of Genotoxicity Effects of Pesticide Exposure on Paddy Workers and Residential Children, Kuala Selangor, Malaysia

Background. Occupational exposure to pesticide is known to cause hazardous health effect to farmers; nevertheless, residential children living near to farmland are currently been highlighted as another vulnerable group since they are less able than adults, physiologically, to protect themselves against pesticides pollutants. Aims. This is a cross-sectional study conducted between paddy farmers and residential children and their controls. Biomarker of exposure is determined through blood cholinesterase level followed by assessing the biomarker of genotoxic effect from mixture of organophosphates (OP) exposure. Methods. Blood cholinesterase level was determined through finger-prick approach. Genotoxicity effect was evaluated by micronuclei (MN) assay and Comet assay for markers of oxidative DNA damage and chromosomal changes. Both assays were performed by sampling exfoliated buccal mucosa in a minimal invasive manner. Results. Statistical analysis showed that both farmers and residential children had negative correlation between blood cholinesterase level and MN frequency and tail length formation. This supports the hypothesis that chronic exposure to mixture of OP reduces the blood cholinesterase level but increase the potential of genotoxic risk. Farmer and residential children has approximately ~1.5-2 folds increase of tail length and MN frequency compare to controls. Besides, these genotoxic biomarkers presumed that residential children performed an early childhood cancer risk (MN, 4.9 ± 2.6; Tail length, 11.2 ± 6.9) due to their 2~2.5 folds of genotoxic effects as compared to adult farmer (MN, 13.4 ± 4.4; Tail length, 24.4 ± 8.2). Conclusion. This study suggested that occupational and community exposure to mixture of OP by farmers and residential children most probably bears a genotoxic risk. It is recommended to integrate genotoxic evaluation approaches into pesticide health risk assessment to further differentiate the potential risk by occupational and residential setting among farmers and residential children.

Abstract Number	**P-3-23-03**
Presenter	Marina Lacasaña*, Rodriguez-Barranco Miguel, Beatriz Gonzalez Alzaga, Clemente Aguilar-Garduño, Antonio F. Hernandez, Tesifon Parron
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cross-sectional study

ASSOCIATION BETEWEEN A RETROSPECTIVE GIS-BASED INDICATOR OF ENVIRONMENTAL PESTICIDE EXPOSURE AND NEURODEVELOPMENT IN CHILDREN

Background: Many studies have associated prenatal and postnatal pesticides exposure with neurodevelopmental impairments in children. South-Eastern Spain has been characterized for decades as a region of intensive agriculture where large amounts of pesticides are used to increase crop fields.Aims: To evaluate the association between postnatal exposure to pesticides and neurodevelopmental deficits in children. Methods: We conducted a cross-sectional study in 268 children 6-12 year-old from an agricultural community in South-Easternof Spain. A questionnaire was applied to their mothers to obtain the residential history from birth to time of interview. Residential exposure of children to pesticides was assessed using a distance-weighted measure of agricultural surface as proposed by Cornellis et al (2009) with an influence radio of 0-250 m, 250-750 m, 750-2500 m and 2500-5000 m. Children's addresses by year were geo-referenced taking into account residential history and circular rings with these radii were drawn around each geographical coordinate. Time-series of crop area per municipality and year, and land-use maps were used to develop each individual indicator. The Wechsler Intelligence Scale for Children-Fourth Edition was individually administered to assess general intellectual ability (Full Scale IQ) and specific cognitive domains. Linear regression models were used to assess the effect on neurodevelopment.Results: An increase in 10 hectares per year of influence of agricultural surface was associated with a decrease of -3.0 points (95% CI: -6.2; 0.2; p=0.069) in Full Scale IQ, adjusted for gender, child's age and maternal education. "Verbal Comprehension" and "Processing Speed" were the domains most affected for increase of pesticide exposure from agricultural surface (ß=-3.4; p=0.035 and ß=-3.2; p=0.028 respectively).Conclusions: Accumulated pesticide exposure as a function of pressure of crop fields could be associated with current neurodevelopment delay in children. Instituto de Salud Carlos III (PI10/01101)

Abstract Number	**P-3-23-04**
Presenter	Riana Bornman*, Rhena Delport, Paulina Farias, Nathalie Aneck-Hahn, Christiaan de Jager
Exposure	pesticides
Health domains	reproductive outcomes
Type of research	cohort study

ASSOCIATION BETWEEN SEX HORMONES AND UPTAKE OF DDT AND METABOLITES IN YOUNG MALES

Background and aim Semen quality and sperm integrity are adversely affected by DDT and metabolites. This study investigated the association between DDT isomer uptake and sex hormone levels in apparently healthy young men from Limpopo Province, South Africa living in a malarial are where DDT is used for Indoor Residual Spraying (IRS). Methods Complete data on serum total (t-T), bio-available (b-T) and free testosterone (t-T) as well as estradiol, LH, and FSH were available from 152 men with no isomer uptake and men mean (SD) age 23(4) years with uptake of p,p'-DDE (n=393), p,p'-DDT (n=362) and o=o,p'-DDT (n=297). Data was normalized using appropriate transformations where indicated. Only hormones significantly correlated with any DDE or DDT isomer ($p<0.2$) were further analyzed through linear regression models. Following bivariate linear regression analyses all independent variables having a statistical association ($p<0.15$) were included in an initial multiple linear regression model for each hormone as dependent variable. A manual stepwise elimination process was followed and variables with a 95% confidence interval not including zero or that changed other coefficients >10%, were kept in the final models. DDT or DDE isomers were introduced separately in each final model keeping the other predictors constant. Results Mean t-T, b-T, f-T and estradiol were consistently higher and FSH and LH were lower when there was any or all isomer uptake. There seemed to be uniformity in the hypothalamic-pituitary-gonadal axis and in the multivariate analysis the direction of associations with p,p'-DDE and p,p'-DDT remained the same. The associations of o,p'-DDT were all negative except for estradiol in this analysis. Conclusions The results suggest that exposure to DDT from IRS may be associated with altered sex hormone homeostasis in young men.

Abstract Number	**P-3-23-05**
Presenter	Cynnie Curl*, Shirley Beresford, Anjum Hajat, Joel Kaufman, Kari Moore, Jennifer Nettleton, Ana V. Diez-Roux
Exposure	pesticides
Health domains	equity
Type of research	cross-sectional study

Associations of organic produce consumption with socioeconomic status and the local food environment: Multi-Ethnic Study of Atherosclerosis (MESA)

Background. In the US, food is certified “organic” when grown without specified pesticides. Consumption of organic food can reduce pesticide exposure and is an opportunity to support farming practices that reduce both risk to farmworkers and environmental contamination. Given potentially higher costs and differences in availability across communities, access to organic food may not be equal. Research has shown that residents of neighborhoods with better access to healthy food tend to have healthier diets. We hypothesize a parallel relationship where access to organic food is associated with its consumption. Aim. To understand the individual- and neighborhood-level factors associated with organic food consumption. Methods. We analyzed the association between organic food consumption and individual characteristics of 4,064 participants in the Multi-Ethnic Study of Atherosclerosis. We also evaluated the relation between organic food consumption and three measures of the local food environment intended to represent food access: 1) supermarket density, 2) self-reported assessments, and 3) aggregated responses of independent informants. Results. Women were 21% more likely to consume organic food than men (confidence interval [CI]:1.12–1.30), and likelihood of organic food consumption decreased by 13% for each additional 10 years of age (CI: 0.84–0.91). Participants with higher education (prevalence ratio [PR]: 1.13, CI: 1.09 –1.17) and income (PR: 1.03, CI: 1.00–1.06) were more likely to consume organic food. Organic food consumption was associated with self-reported assessment of produce availability (PR: 1.06, CI: 1.02–1.11), with an aggregated measure of perception of the local food environment (PR: 1.08, CI: 1.00–1.16), and, to a lesser degree, with supermarket density (PR: 1.02: CI: 0.99-1.05). Conclusion. Both individual-level factors and the local food environment are associated with organic food consumption.

Abstract Number	**P-3-23-06**
Presenter	Riana Bornman*, Henrik Kylin, Henk Bouwman
Exposure	pesticides
Health domains	policy
Type of research	others

Challenges following successful IRS: what female caregivers told us

Background: Mothers, guardians and caregivers of children play a vital role in the prevention, early detection and management of malaria. The general and daily priorities of caregivers living in a malarial area are not well understood, particularly as they have to balance competing social, economic and health constraints. A better understanding of household behaviour with respect to health education is imperative for the reduction of malaria incidence and the success of malaria control strategies. Aims: We evaluated how female caregivers manage social, economic and health imperatives in communities under a successful annual indoor residual spraying (IRS) malaria control programme. Materials and methods: We conducted interviews with 156 caregivers of children using both open-ended and closed fixed-answer questions. Adult females were interviewed in two malarial villages subject to IRS (n= 120, 60 in each village), and 36 women from a reference non-sprayed village. Results: The mean income was considerably lower than the national mean, indicating a community under considerable pressure with the male parents were often absent due to work commitments elsewhere. Unemployment, poverty, crime, and lack of clean water were the main, unprompted, threats, but malaria was volunteered by none. Only when malaria was prompted (caregivers had good knowledge of malaria), did its concern rise to 52% and 38% respectively in the IRS-sprayed villages. Conclusions: Malaria was not a prominent conscious concern for female caregivers living in this malarial area with successful vertical malaria control. Poor communities may not be able to adopt community-active challenges. Considerations should be given to the needs requirements of the caregiver as a crucial component of rural community life as their ‘buy-in’ to any new measures will be crucial for success. Acknowledgements: This study was funded by the National Research Foundation of South Africa (NRF FA2006031000002).

Abstract Number	**P-3-23-07**
Presenter	Kristina Whitworth*, Riana Bornman, Gregory Travlos, Ralph Wilson, Matthew Longnecker
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Determinants of plasma DDT and DDE concentrations among South African Women exposed to indoor residual spraying for malaria control

Background/Aims: Determinants of internal exposure to DDT and DDE among people who live in homes sprayed with DDT for malaria control have been little-studied. Methods: This analysis includes 383 women aged 20-30 years enrolled in the South African Study of Women and Babies from 2010-2011 from 8 villages in Limpopo, of which indoor residual spraying (IRS) occurred in half. Information related to sociodemographics, reproduction, diet, housing, water, and items related to IRS (i.e. covering household items before IRS) were obtained as well as anthropometry and blood samples. Statistical Analysis: Analyses were conducted separately for women in unsprayed villages (N=176), women in IRS villages in households with a high likelihood of DDT use (N=107), and women in IRS villages in households with a low likelihood of DDT use (N=100). Plasma levels of DDT and DDE were natural log-transformed and multivariable models were fit, using forward stepwise selection. Lipid levels were forced into each model. Results: Median levels of DDT and DDE (µg/L) were: 0.9 (IQR:0.3-2.6) and 4.9(IQR:1.5-11.0). In unsprayed villages, women with water piped to the yard had 74% lower DDT levels and 60% lower DDE levels than women using a public tap. In IRS villages, in households with low likelihood of DDT use, no factor accounted for a majority of the variance in the DDT model and parity was the only determinant in the DDE model; parous women had lower DDE levels. In IRS villages, in households with a high likelihood of DDT use, owning livestock accounted for 95% higher DDT levels and 87% higher DDE levels. Discussion: The identification of primary determinants of DDT and DDE may inform targets for interventions aimed at decreasing exposure. In unsprayed villages, clean water may be such a target. Among households where DDT is likely to be used for IRS, raising livestock appears to be an important determinant of internal exposure.

Abstract Number	**P-3-23-08**
Presenter	Katarina Banyiova, Pavel Cupr*
Exposure	pesticides
Health domains	other
Type of research	exposure measurement

Experimental refinement of dermal exposure for human health risk assessment of CHLOROTOLURON

Background: Chlorotoluron is a phenylureaherbicide. It is detected in surface and groundwatersall over the world. Although it has been evaluated for its dermal absorption during registration process, there is lack of available scientific data for calculating the risk that results from dermal exposure to this herbicide. Aims: The aim of this work was to measure the experimental dermal absorption of chlorotoluron andto calculate the permeability coefficient (Kp) and lag time (τ). These are used in many models as a value expressing the rate of dermal absorption. Human health risk assessment for dermal exposure in different scenarios has been done. Methods: Split-thickness abdominal pig skin was used, the dermalabsorption was measured using automatic system of static diffusion Franz cells (Microette, Hanson, infinite dose condition. The duration of the experiment was 24 hours so the steady-state flux (Jss) was achieved. Results: Jsswas achieved after 2,6 hours (lag time) of the experiment and it was equal to 0,0346 mg cm-2h-1. Experimental permeability coefficient (Kp) for chlorotoluronis 3.46 10-3 cm h-1. Conclusions: The Jss and Kp measured in this work are useful for risk assessors to evaluate the dermal risk of chlorotoluronin water. We used US EPA equation for calculating the dermal absorption of chlorotoluron from water in 6 different scenarios. The experimental values of dermal absorption kinetics are essential for accurate risk assessment. Dermal absorption values with a description of method used to generate them should be required during the registration process and accessible for the community of risk assessors.

Abstract Number	**P-3-23-09**
Presenter	Maartje Brouwer*, Anke Huss, Roel Vermeulen, Peter Nijssen, Geert De Snoo, Hans Kromhout
Exposure	pesticides
Health domains	no health domain
Type of research	exposure modeling

Expert elicitation applied for reconstructing historical pesticide usage patterns

Background: Retrospective assessment of environmental pesticide exposure is challenging. While spatially resolved historical data on agricultural land-use may be present, detailed information on crop-specific pesticide use is often lacking historically. We aimed to determine to which extent expert elicitation can be a valuable tool for reconstructing historical pesticide usage patterns in the Netherlands. Methods: Six main crops in the Netherlands were selected and information on crop-specific pesticide use between 1960 and 2005 was collected by interviews. Two experts per crop identified pesticides (active ingredients) used per 5-year time window and assigned relative importance by estimating the percentage of farmers applying that pesticide. Recall was enhanced by use of check lists of pesticides allowed on a crop per time period. Inter-rater agreement was investigated by weighted Cohen's Kappa scores. Average expert estimates were compared with data from national pesticide surveys among farmers to assess validity of the responses. Results: Inter-rater agreement varied between crops, but overall agreement on pesticide use was fair to good (w.κ. 0.45-0.69), except for cereals (w.κ. 0.25) and tulips (w.κ. 0.32). Comparisons between average expert estimates and pesticide survey data indicated fair to good agreement for all crops (w.κ. 0.42-0.65). Agreement tended to be higher for herbicides and fungicides. Conclusions: Despite differences between crops, inter-rater agreement was overall fair to good. Comparison with recent pesticide survey data also revealed fair to good agreement. These results indicate that expert elicitation may be a valuable tool for reconstructing complex historical crop-specific pesticide usage patterns. We will combine this information with spatially and temporally resolved information on agricultural land use and residential histories in order to assess environmental exposure to pesticides for epidemiological studies.

Abstract Number	**P-3-23-10**
Presenter	Antonia M. Calafat*, Samuel Baker, Amanda Bishop, Pilar Morales-A
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Exposure to the insect repellent N,N-Diethyl-m-Toluamide (DEET) in the United States

Background: In 1946, the US Army developed N, N-Diethyl-m-toluamide (DEET). Since then, DEET has become the most effective and ubiquitous insect repellent in the United States. There are hundreds of insect repellent commercial formulations containing DEET at concentrations ranging from 4% to 100%, and human exposure to DEET is expected to occur. However, information on the extent of such exposure is rather limited. Aims: To evaluate human exposure to DEET by using the urinary concentrations of DEET and several of its metabolites. Methods: We determined the urinary concentrations of DEET and three DEET metabolites—N-ethyl-3-methylbenzamide (M1), N, N-diethyl-3-hydroxymethylbenzamide (M3), and 3-(diethylcarbamoyl)benzoic acid (M4)—by on-line solid-phase extraction–isotope dilution-high performance liquid chromatography–tandem mass spectrometry in convenience samples of U.S. residents with no known occupational exposure to DEET. Results: We detected M4, and to a lesser extent M1, most frequently and at the highest concentrations. By contrast, we detected DEET much less frequently and at concentrations orders of magnitude lower than those of M4. Conclusions: The significantly higher frequency of detection and urinary concentrations of certain DEET metabolites (e.g., M4, M1) than of DEET confirm the validity of these metabolites as biomarkers for DEET exposure assessment and suggests widespread exposure to DEET among the U.S. general population. More important, these data also suggest that the occurrence of exposure to DEET could be underestimated by using DEET as the sole urinary biomarker, particularly when evaluating background envi-ronmental exposures.

Abstract Number	**P-3-23-11**
Presenter	Jeffrey Blain*, Virginie Chasles, John R. Nuckols, Alice Denoyel, Béatrice Fervers
Exposure	pesticides
Health domains	other
Type of research	review

GIS-based approaches to assess environmental exposure to agricultural pesticides in health: Review of the literature

Background: Exposure to agricultural pesticides has been shown to impact human health and is associated with several diseases, e.g. cancer. Assessment, in particular retrospectively, is difficult due to lack of exposure data at the individual level and limits of classical epidemiological methods (recall bias). Geographic Information Systems (GIS) offer the possibility of analysing exposure at a fine scale, reducing misclassification and thus improving health risk estimates. Aims: To analyze GIS methods for pesticides exposure assessment and to highlight differences and overlaps in data and techniques across peer-reviewed published studies. Methods: We conducted a systematic literature review combining terms related to GIS, exposure, pesticides and health, producing 1161 papers published 1980 to 2013. Based on review of title and abstract, we selected 50 papers using GIS to assess agricultural pesticide exposure in the general population, including epidemiological and environmental health studies. We analysed the 50 studies in terms of design, data sources and analytical methods. Results: Most were epidemiology studies conducted in California where pesticide use reporting (PUR) is mandatory. Studies were mostly case-control design regarding cancer and neurological disorders. Populations were derived from disease registries or other recruitment, resulting in high variation in geocoding accuracy. Most studies included land use and pesticide data varying in geographic resolution, and from PUR (1 mi2) to field level applications. Most used 500m circular buffers to define pesticide source area. Methodological studies using larger buffers found improved prediction in metric validation. Use of meteorological and topographic data was rare and heterogeneous. Conclusion: GIS improves assessment of agricultural pesticides exposure in the general population when accurate geocoding, source location, and metric design are used and particularly with mandatory reporting (PUR).

Abstract Number	**P-3-23-12**
Presenter	Sonia El-Zaemey, Jane Heyworth, Lin Frtischi*
Exposure	pesticides
Health domains	cancer
Type of research	case-control study

Household and occupational exposure to pesticides and risk of breast cancer

Background: Pesticides are widely used in households and workplaces to control for undesirable pests. Much of the epidemiologic research on this subject has been focused upon examining the relationship between breast cancer and body burden levels of organochlorine pesticides. However, little data exist regarding the association between the use of household or occupational pesticides and the risk of breast cancer. Aims: To examine the relationship between household and occupational pesticide exposure and the risk of breast cancer in a case-control study in Western Australia. Methods: Between May 2009 and July 2011, incident cases of breast cancer and frequency matched controls selected from the general population were enrolled. Information on household pesticide exposure was collected by questionnaire. For occupational pesticide exposure job-specific modules were used. To evaluate potential recall bias, we stratified the analysis by belief about whether pesticides contribute to breast cancer. Unconditional logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CI). Results: Women's exposure to pesticides in households and workplaces were not related to increased risk of breast cancer; OR=1.10; CI: 0.86-1.37 and OR=0.77; CI: 0.45-1.32, respectively. There was a low prevalence of occupational exposure to pesticides among women. In the stratified analyses, the odd ratios for breast cancer and household pesticide use was not significantly different between women who reported that they believed that pesticides increased breast risk and those who did not report this. Conclusions:Overall, the results of our study did not find a relationship between exposure to pesticides in the workplace or household and breast cancer. However few women were exposure occupationally and thus the power to investigate this exposure was low. Future studies, utilizing a larger sample size and more specific detail on the time frame of pesticide exposure, are needed to further explore this question.

Abstract Number	**P-3-23-13**
Presenter	Shilpa Narayan, Zeyan Liew, Kimberly Paul, Pei-Chen Lee, Janet S. Sinsheimer, Jeff M. Bronstein, Beate Ritz*
Exposure	pesticides
Health domains	neurodegeneration
Type of research	case-control study

Household Organophosphorus Pesticide Use and Parkinson's Disease

Background: Household pesticide use is widespread in the United States. Since the 1970s, organophosphorus chemicals (OPs) have been common active ingredients in these products. Parkinson's disease (PD) has been linked to pesticide exposures but little is known about the contributions of chronic exposures to household pesticides. Aims: Investigate whether long-term use of household pesticides, especially those containing OPs, increases the odds of PD. Methods: In a population based case-control study, we assessed frequency of household pesticide use between ages 16-<45 years for 357 cases and 807 controls relying on the California Department of Pesticide Regulation product label database to identify ingredients in reported household pesticide products and the Pesticide Action Network pesticide database of chemical ingredients. Using logistic regression we estimated the effects of household pesticide use. Results: Frequent use of any household pesticide increased the odds of PD by 39% [odds ratio (OR) =1.39 (95% confidence interval (CI): 1.06, 1.83)]; frequent use of products containing OPs increased the odds of PD more strongly by 82% [OR=1.82 (95% CI: 1.26, 2.63)] and frequent organothiophosphate use more than doubled the odds of PD. Sensitivity analyses showed that estimated effects were independent of other pesticide exposures (ambient and occupational) and the largest odds ratios were estimated for frequent OP users who were carriers of the 192QQ paraoxonase genetic variant related to slower detoxification of OPs. Conclusions: We provide evidence that household use of OP pesticides is associated with an increased risk of developing PD.

Abstract Number	**P-3-23-14**
Presenter	Edith Berger-Preiss*, Susanne Gerling, Heiko Kock, Wolfgang Koch
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Indoor biocide concentrations after application of biocidal aerosol sprays

Biocidal sprays are frequently used by consumers in indoor areas to control pests.To obtain data on indoor contaminations, different insecticide aerosol sprays were applied in furnished model rooms (40 m^3). On the one hand, the sprays were used according to the manufacturers' instructions (spraying for about 10-20 sec), and on the other hand under worst-case conditions (spraying for 2 min). Within two weeks, four spray applications with correct use and three worst-case applications were performed. Indoor air was collected a) during the spraying process, b) 2-4 h after spraying (in case of correct use the room was ventilated for 30 min), and c) about two weeks after the last application. The applied sprays contained i) tetramethrin/d-phenothrin (0.15 g/0.15 g), ii) pyrethrum extract/PBO (0.25 g/1g), and iii) chlorpyrifos/bioallethrin/PBO (0.5 g/0.15 g/n.s.) per 100 g spray. During spraying, concentrations of biocides in the air (mean values from 3 or 4 measurements) ranged from 100-1020 µg/m^3 for correct use (290-6020 µg/m^3 for worst case). Highest concentrations of 2510 µg/m^3 (10340 µg/m^3) were measured for the synergist PBO. Two to four h after application, concentrations of the active ingredients in the indoor air were down to 0.1-0.8% (1-11% for worst case). Three weeks after the last application, concentrations between 0.02-1 µg/m^3 were measured for both scenarios. To determine the surface load, pads of filter paper were placed horizontally at different positions in the room. The amounts of active ingredients were determined at different times (after first and last applications and about two weeks later). Concentrations varied from 10-480 ng/cm^2 (70-5700 ng/cm^2 for worst case) for biocides and from 300-2260 ng/cm^2 (1000-16500 ng/cm^2 for worst case) for PBO. After 2 weeks, bioallethrin had been degraded, the other biocide concentrations were down to 10-40% (40-70% for worst case). The PBO value remained constant over time.

Abstract Number	**P-3-23-15**
Presenter	Kathleen Attfield*, Gary Adamkiewicz, Michael Hughes, John D. Spengler, Lin Tao, Michaela Kapp, Chensheng Lu
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Integrated Pest Management and children's exposures to pyrethroids in low-income public housing dwellings in Boston, MA

Background: Pyrethroid pesticides are used extensively in agriculture and in home and building applications. Children are recognized as most at risk to dietary and residential exposures due to their still developing organs and underdeveloped detoxification processes. Integrated pest management (IPM) in housing is gaining popularity as a more comprehensive and less pesticide-driven method for reducing pests, however IPM programs instituted by large housing complexes have not been evaluated for efficacy. Aims: We sought to evaluate whether a newly introduced IPM program in low-income housing could alter children's pyrethroid exposures. Methods: We tracked 20 children in a Boston public housing complex over 18 months, collecting urine samples over 3-day periods for each of 6 consecutive months before and after IPM implementation with six months between (up to 72 samples per child). Samples were analyzed for 6 pyrethroid metabolites. Results: Prior to IPM implementation, one or more pyrethroid metabolites were present in every urine sample, with cis- and trans-2,2-(dichloro)-2-dimethylvinylcyclopropane carboxylic acid (DCCA) , 3-phenoxybenzoic acid (3PBA), and cis-2,2-(dibromo)-2-dimethylvinyl-cyclopropane carboxylic acid (DBCA) detected in over 89% of samples. Remaining metabolites were detected in under half of collected samples. While 3PBA and DCCA medians (0.5 ng/ml) were similar to National Health and Nutrition Evaluation Survey values, 95%ile values rose to 7 ng/ml and peak exposure events (up to 235 ng/ml (DCCA) and 372 ng/ml (3PBA)) were 5-11 times higher than other studies. FPBA and DBCA stayed below 1 ng/ml up to the 95%ile. Post-IPM urine levels will be reported and compared to pre-IPM samples. Observations of IPM performance included a decline in pesticide use by families. While visits by pest professionals increased, use of pyrethroid sprays remained low and widespread application of baits and gels were reported. Conclusions: Pesticide exposures are common in low income housing and use of IPM may serve to reduce children's exposures.

Abstract Number	**P-3-23-16**
Presenter	James Grellier*, Lesley Rushton, David J. Briggs, Mark J Nieuwenhuijsen
Exposure	drinking water
Health domains	cancer
Type of research	review

Lessons in cancer burden assessment related to disinfection by-products

Background Understanding the public health implications of chemical contamination of drinking water is important for various stakeholders. The potential cancer burden associated with exposure to disinfection by-products (DBPs) is of particular interest due to their widespread occurrence and the fact they occur as a result of controlling microbial quality of drinking water. Aims We aimed to identify the methods used to assess cancer burden assessments in the literature, and to evaluate the effectiveness of these methods in describing cancer risk in populations exposed to DBPs. Methods We searched the literature for studies that have assessed the population health impacts associated with the carcinogenic risk of DBPs in drinking water. We evaluated these assessments in terms of their objectives, methods, how uncertainties were dealt with, and how the results were interpreted and presented. Results In total we identified 24 studies matching our criteria. With some notable exceptions, the majority of studies based their risk estimates on toxicological data that had been produced with a regulatory, health protective purpose in mind. Such assessments therefore potentially produce upwardly biased estimates of generic cancer risk and provide no estimation of the uncertainties associated with these estimates. Conclusions We recommend that future studies should explicit define the scope of their assessment, by incorporating up-to-date epidemiological data, by considering uncertainties in exposure assessment and risk characterisation steps, and by transparently reporting on these issues in their results.

Abstract Number	**P-3-23-17**
Presenter	Adalberto Luiz Miranda-Filho*, Sergio Koifman, Gina Torres Monteiro
Exposure	pesticides
Health domains	cancer
Type of research	case-control study

LEUKEMIA MORTALITY AMONG AGRICULTURAL WORKERS, RIO DE JANEIRO, BRAZIL: AN ECOLOGICAL POPULATION-BASED CASE-CONTROL STUDY, 2006 - 2010

Background: Several studies have shown that agricultural workers have at greater risk to develop cancer, including leukemias. Occupational exposure to pesticides and biological agents have been reported as possible associated risk factors. Aims: To estimate the magnitude of association between leukemia mortality and agricultural activities after controlling for selected confounders such as ethnicity, education, and place of residence. Methods: A death certificate-based case-control study was performed with 566 leukemia deaths (cases) and 1,132 deaths (controls) with other than cancer causes of death. All data were retrieved from death certificates occurred in Rio de Janeiro State, Brazil, during 1996-2010 among male > 17 yr. residents. Results: Agricultural workers were at higher risk to die by leukemia, when compared to non-agricultural workers (crude OR= 1.75; CI99%: 0.91-3.38). Adjustment by age, ethnicity, and residence showed and adjusted OR= 3.52; CI99%: 1.50-8.25). In addition, brain cancer mortality risk was higher among those individuals of higher education and white residing in selected counties. Conclusions:This study suggests an associationamong agricultural work and leukemia mortality inRio de Janeiro state. Our results reinforce the hypothesis that environmental exposures experienced by this group of workers may play a role in the development of leukemia.

Abstract Number	**P-3-23-18**
Presenter	Miguel Ángel Karam-Calderón*, Lilia Patricia Bustamante-Montes
Exposure	pesticides
Health domains	healthrelated quality of life
Type of research	others

Perceptions of young people florists pesticide use. A gender approach

Background: The municipality of Villa Guerrero, Mexico has been characterized in the past 2 decades, floriculture growth, while the use of large quantities of pesticides. Given the lack of opportunities to study and work, more and more young people working in the flower grow, both at home and in companies where working conditions generally are not appropriate to the use of pesticides. Aims: Identify factors that influence risk perception that young people have to pesticides, from a gender perspective Methods: A mixed study was conducted integrating quantitative methodology with a questionnaire and qualitative method using focus groups (one male, one female and one male and female) was analyzed as the idea of risk structure and shape to perceive, from a gender perspective. Statistical analysis was by multiple regression model and the qualitative semiotic, was integrated through data triangulation. Results: Youth with regular programs of health education, have an attitude toward risk in a way that we have called "arrogance informative", understood as a behavior that gives "identity" to youngpeople and makes feel that "as they know, nothing happens to them"and therefore they don't wear protective gear and make risky activities without it. Furthermore, due to age, men are structuring their masculinity, so they have a higher risk-taking behavior than women, who are building their femininity. This manifests itself in a different exposure by sex, since men are more exposed than women, who only help men at work Finally, it is reported that the only risk is perceived as "having no money", because according to them "having money could also cure the pesticides effects". Conclusion: Due to the process of construction of masculinity, men engaged in higher risk than women. In addition, young people perceive as a higher risk not having a job that the use of pesticides, "if they have a job then you have money," and money is more important than health.

Abstract Number	**P-3-23-19**
Presenter	Chloé Cartier*, Charline Warembourg, Christine Monfort, Florence Rouget, Gaïd Le Maner-Idrissi, Gaël Durand, Dave Saint-Amour, Sylvaine Cordier, Cécile Chevrier
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cohort study

Prenatal exposure to organophosphate insecticides and cognitive function of 6 years old children in the mother-child PELAGIE cohort (France)

Background: Organophosphate pesticides (OP) were commonly used in agriculture and residential settings in the last decades. Three American cohorts have recently showed associations between prenatal OP exposure and cognitive deficits in children. Aims: To investigate among 6-year old children the relationship between prenatal urinary OP levels and scores of the Wechsler Intelligence Scale for Children (WISC-IV) used in the previous cohorts. Methods: From a random subcohort of the PELAGIE cohort that included 3500 pregnant women in Brittany (France, 2002-2006), 231 children were followed at 6-year old for neuropsychological assessment. Prenatal exposure was determined by assessing OP metabolites (Dialkylphophate DAP, Diethylphosphate DE and Dimethylphosphate DM) in maternal urine samples collected during the first trimester of pregnancy. The WISC-IV was used to obtain a working memory index and a verbal comprehension index. Preliminary analyses based on multivariate regressions were conducted controlling for potential confounding factors including family stimulation from the Home Observation for Measurement of the Environment scale. Results: Mean DAP, DE and DM detected concentrations in nmol/L were 81.0 (n=211), 22.7 (n=115), 69.9 (n=207) respectively. Adjusted means of the WISC indexes did not differ between quartiles of urinary levels of DAP metabolites (from the lowest to the highest quartile ; WM : 107.04, 105.29, 105.62, 109.79; CV : 104.67, 105.73, 110.24, 107.89), nor for DE or DM metabolites. Conclusions: This study did not observe association between prenatal urinary OP levels and WISC scores in 6-year old children. Inconsistency with the previous results might be explained by lower OP levels or no ethnic minority in our study population.

Abstract Number	**P-3-23-20**
Presenter	Sarah Tozer*, J F Nash, E.J. Daly
Exposure	others
Health domains	other
Type of research	exposure measurement

Probabilistic Aggregate Exposure Modelling for a Broad Spectrum Antimicrobial in Personal Cleansing Products

Background:Realistic estimates of chemical aggregate exposure are needed to ensure consumer safety and satisfy the requirements of regulators. In most cases, aggregate exposure is estimated simply by adding deterministic exposures from all product types containing the chemical. However, this summation will result in an unrealistically-conservative estimate since individuals vary in their patterns of product use, and it is very unlikely that consumers use high levels of all products at the same time. As aggregate exposure estimates could be used to calculate acceptable “safe levels” and conduct risk assessments for chemicals, methods are needed to produce realistic exposure estimations. Methods: A probabilistic aggregate exposure model was developed to estimate consumer exposure in Europe and North America to a hypothetical broad spectrum biocide, from a range of rinse off personal cleansing products. It incorporates large habits and practices surveys, from industry/cosmetic trade associations, containing data on frequency of use, amount, co-use along with market share, and combines these data at the level of the individual based on subject demographics (gender, age, ethnicity) to realistically calculate exposure. Results: When the antimicrobial was assumed present in five rinse off products (Shampoo: 2% and other products: 0.5%), the average daily applied exposure (amount applied to the skin) was estimated at 1.65 mg/kg/day for the average person and 3.79 mg/kg/day for the 95th percentile consumer. This probabilistic modelling offers significant exposure refinement versus deterministic aggregate summation methods. Conclusions: This probabilistic aggregate exposure model provides robust data that can be used in the human safety assessment of multiple rinse-off technologies (e.g., shampoo, bar soap, body wash, liquid hand soap) containing the biocide. In addition, this model may be used in other situations where refined exposure assessment is required to support a chemical risk assessment.

Abstract Number	**P-3-23-21**
Presenter	Marsha Morgan*, Denise MacMillan, Dan Zehr, Lillian Alston
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Pyrethroids and their environmentally-degraded metabolites in duplicate diet samples from the Ex-R study

Background: Pyrethroid insecticides have been found in a number of different types of foods consumed by people worldwide. However, data are currently lacking on the concurrent measurement of pyrethroids and their environmentally-degraded 'metabolites' in typical diets. As these same metabolites are also used as urinary biomarkers of exposure, their presence in food samples could confound dietary exposure estimates to pyrethroids. Aims: The Pilot Study to Estimate Human Exposures to Pyrethroids Using an Exposure Reconstruction Approach (Ex-R study) is examining the everyday exposures of 50 adults to pyrethroids in residential settings. One major study objective is to estimate the dietary exposures of adults to pyrethroids and to their metabolites. Methods: Field activities occurred at the USEPA Human Studies Facility in North Carolina, USA and at the participants' homes within a 40-mile radius of this facility between November 2009 and May 2011. Participants collected their own food, water, dust, surface wipe, and urine samples and completed daily food, activity, and pesticide-use diaries for a total of three weeks over a six-week monitoring period. For each participant, duplicate diet samples consisted of all foods, excluding beverages, consumed during each of three time periods per sampling day (six days total). Food samples were homogenized, extracted, and analyzed by LC/MS/MS for seven pyrethroids (bifenthrin, cyhalothrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, and permethrin) and for six of their metabolites. Results: Preliminary data show that the pyrethroids and their metabolites were detected in less than 34% and 3% of the food samples, respectively. Of the metabolites, only DCCA was detected above 1.0 ng/g in the food samples. Conclusions: The low incidence of metabolites in the food samples suggests that their use as urinary biomarkers is likely not significantly impacted by their presence in the diet.

Abstract Number	**P-3-23-22**
Presenter	Peter Fantke, Olivier Jolliet*
Exposure	pesticides
Health domains	healthrelated quality of life
Type of research	health impact assessment

Quantification of health impacts from food crop consumption in Europe

Background. Food crop consumption is the predominant exposure pathway of the general public toward pesticides. Until now, health impacts of overall human exposure to pesticides used for specific crops have never been quantified. Aims. We aimed at quantifying the human health impacts of pesticides, detailing how pesticides contributed annual impacts to the value of an average burden of lifetime lost per person across Europe in 2003. Methods. We investigated human exposure to 133 pesticides applied in 24 European countries in 2003. We looked at the five most extensively used pesticides per crop using a combination of a dynamic multi-crop uptake model and a steady-state fate and exposure assessment tool, to characterize how pesticides affected the general population. From the results, we created a table of health impacts per kilogram of applied pesticide. Results. Overall, pesticides contributed annually to around 2000 disability-adjusted life years in Europe, to which only 13 substances applied to grapes/vines, fruit trees, and vegetables accounted for 90% of total annual health impacts. The burden per person in hours lost over lifetime was 2.6. Compared with figures for the burden from particulate matter in the air (195 days) or passive smoking (24 days), this figure is relatively low. However, uncertainties in our results highlight the figure could be somewhat higher, ranking pesticides with other important environmental stressors in health impact terms. On a positive note, 33 of the 133 assessed substances (which accounted for 20% of health impacts) are now banned in Europe. Conclusions. Our research has important policy implications, as the first attempt to quantify the extent of pesticides' health impacts in Europe at the level of individual pesticides, crop classes and country. However, some uncertainty will always remain, due to the fact that pesticides cannot ethically be tested on humans to find out their health effects directly.

Abstract Number	**P-3-23-23**
Presenter	Hiroshi Nomura*, Jun Ueyama, Takaaki Kondo, Isao Saito, Katsuyuki Murata, Toyoto Iwata, Shinya Wakusawa, Michihiro Kamijima
Exposure	pesticides
Health domains	no health domain
Type of research	exposure measurement

Quantitation of neonicotinoid metabolites in human urine using gas chromatography-mass spectrometry

Neonicotinoid insecticides (NEOs) are widely used in agriculture as foliar and seed treatments, for indoor and outdoor insect control, home gardening and pet products. The aim of this study is to develop and validate a simple method for quantitation of urinary NEO metabolites, 6-chloronicotinic acid (6CN), 2-chloro-1,3-thiazole-5-carboxylic acid (2CTCA) and 3-furoic acid (3FA) for biomonitoring of NEO exposure. The sensitivity and reliability of our method were examined in this study. Two mL urine was pipetted into a test tube, and 50 µL H2SO4 (5 mol/L) and I.S. solution (10 mg/L isotope labeled 3PBA) were added for deconjugation procedure. After incubation at 86 oC for 2 hours, the solution was loaded into preconditioned SPE cartridge (Bond Elut Plexa PCX, Agilent Technologies). After the wash by 500 µL formic acid solution (2%), the SPE cartridge was dried under vacuum for 3 min and eluted with 500 µL methanol. The eluate was divided into two equal volumes in test tubes. These eluates were dried up with N2 gass, and the residues were resolved with 250 µL acetonitrile in one test tube for 6CN and 2CTCA or with 250 µL toluene in another test tube for 3FA. After derivatization using 40 µL N,O-bis (trimethylsilyl) trifluoroacetamide with 1% trimethylchlorosilane, each of 1 µL sample was separately analyzed by gas chromatography-mass spectrometry. The regression equations ranging from 0.6 to 10 µg/L were y=0.013x+0.0015 (r2=0.999) for 6CN, y=0.0054x+0.0002 (r2=0.999) for 2CTCA and y=0.0048x+0.0013 (r2=0.997) for 3FA. Our present method is simple, sensitive and reliable for the determination of urinary 6CN, 2CTCA and 3FA, i.e. lower limit of detection (0.1 µg/L for each metabolites) compared with previous reports with satisfactory intra- and inter-day accuracy and precision (variability less than 12.3 %, R.S.D). This is the first report about determination of 2CTCA and 3FA in urine to the best of our knowledge.

Abstract Number	**P-3-23-24**
Presenter	Taneshka Kruger*, Christiaan de Jager, Walter Focke, Mthokozisi Sibanda, Riana Bornman
Exposure	pesticides
Health domains	no health domain
Type of research	cohort study

Slow release pyrethroid-impregnated indoor linings as a new malaria vector control method

Background: Indoor Residual Spraying (IRS) and Long-Lasting Insecticide-Treated Nets (LLINs) are the most effective malaria vector control methods. The organochloride pesticide, DDT, is still used for IRS and can retain its efficacy for up to twelve months. However, research indicated that harmful levels of DDT residues are present in indoor air for up to three months after spraying. LLINs only provide protection if people sleep under the net. Certain polymers with insecticide embedded in the fibre can be used as slow release carriers for vector control, possibly becoming a long term substitute for IRS. Aims: To assess the efficacy, durability and community acceptability and perceived efficiency of pyrethroid-impregnated linings in community homes in Limpopo province, South Africa, over a six month period. Methods:A field trial is currently taking place in the community village of Tshilivho in Vhembe district, Limpopo. Forty households (20 mud huts and 20 brick houses) are included. Monofilament polyethylene meshing with one of two deltamethrin-, one of two α-cypermethrin concentrations, or no insecticide were attached along the inside wall of one sleeping hut or room per household. Data on acceptability is gathered with questionnaires, and lining samples are tested bi-monthly for efficacy according to WHO recommended bioassays. Results: The linings yielded positive results in initial laboratory bioassays from field samples collected up to date. Test mosquitoes were exposed for 30 minutes to field samples, resulting in 100% knockdown (KD) within this time. Within 24 hours 100% mortality was noted. Preliminary questionnaire data show that the linings are killing mosquitoes on contact and also less biting is reported. Conclusions:Preliminary results indicate that the use of these pyrethroid-impregnated indoor linings is potentially as successful as IRS. This new and potentially safe method might be a more sustainable approach for vector control. Acknowledgements: The study is supported by the University of Pretoria Centre for Sustainable Malaria Control.

Abstract Number	**P-3-23-25**
Presenter	Gamola Fortenberry*, John D. Meeker, Brisa N. Sánchez, Dana Boyd Barr, David C. Bellinger, Lourdes Schnaas, Maritsa Solano-González, Adrienne Ettinger, Mauricio Hernández-Avila, Howard Hu, Martha Maria Tellez-Rojo Solis
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	cohort study

Urinary 3, 5, 6-trichloro-2-pyridinol in pregnant women from Mexico City: distribution, temporal variability, and relationship with child attention/hyperactivit

Background: Attention Deficit Hyperactivity Disorder (ADHD) is the most commonly diagnosed and studied cognitive and behavioral disorder in school-age children. The etiology of ADHD and ADHD-related behavior is unclear, but genetic and environmental factors, such as pesticides, have been hypothesized. Aims: The objective of this study was to investigate the relationship between in uteroexposure to chlorpyrifos, chlorpyrifos-methyl, and/or 3, 5, 6-trichloro-2-pyridinol (TCPY) and ADHD in school-age Mexican children. The temporal reliability of repeated maternal urinary TCPY concentrations across trimesters was also explored. Methods: From a prospective birth cohort, third trimester urinary TCPY concentrations in 187 mother-child pairs were measured. Child neurodevelopment in children 6-11 years of age was assessed using Conners' Parental Rating Scales-Revised (CRS-R), Conners' Continuous Performance Test (CPT), and Behavior Assessment System for Children-2 (BASC-2). Multivariable linear regression models were used to test relationships for all children combined and also stratified by sex. Intraclass correlation coefficients (ICC) calculations were based on a random effects model. Results: The ICC was 0.41 for uncorrected TCPY, and ranged from 0.29 to 0.32 for specific gravity-corrected TCPY. We did not observe any statistically significant associations between tertiles of maternal TCPY concentrations and ADHD-related outcomes in children, however, we found suggestive evidence of effect modification by sex for ADHD in boys (β= 5.55 points; 95% CI(-0.19, 11.3); p=0.06) and attention problems in girls (β=5.81 points; 95% CI(-0.75, 12.4); p=0.08). Conclusions: Considering the continued widespread agricultural and possible residential use of chlorpyrifos and chlorpyrifos-methyl in Mexico and the educational implications of cognitive and behavior deficits, these results are important and deserve further study.

Abstract Number	**P-3-24-01**
Presenter	Matthew Lorber*, Andre Schutze, K. Gawrych, Holger M. Koch, Thomas Brüning
Exposure	organic compounds
Health domains	neurodevelopment
Type of research	exposure modeling

A pharmacokinetic model to predict urinary concentrations of DINCH metabolites

We developed and calibrated a simple pharmacokinetic (PK) model to predict urinary concentrations of the specific diisononylcyclohexane-1,2-dicarboxylate (DINCH) metabolites. DINCH is cleaved into the simple monoester MINCH, and further oxidizes to the hydroxylated monoester (OH-MINCH), carboxylated monoester (cx-MINCH), and the oxo group containing monoester (oxo-MINCH). All metabolites investigated can be broken down to the unspecific cyclohexene-1,2-dicarboxylic acid. This descriptive model has 4 compartments: a "stomach" (S) compartment, a "lipid" (L) compartment, a "blood" (B) compartment and a "bladder" (BL) compartment. DINCH is assumed to first deposit into the S reservoir, with transfer (before metabolism) split between an L compartment and a B compartment. Unmetabolized DINCH from the L compartment then transfers to the B compartment. Metabolism of DINCH is assumed to occur in the B compartment before transfer to the BL compartment. At each urination event, all the metabolite in the BL is excreted. The model was calibrated using published urine metabolite data from 3 different male volunteers, each orally dosed with approximately 50 mg DINCH. Full urine voids were taken for 48 hrs after dosage. Calibration parameters in this model include removal rates from each compartment and blood volume of distribution. Because of the descriptive nature of this simple PK approach, we excluded CHDA because it is unspecific and a possible breakdown product of all metabolites investigated. The predicted values showed good agreement with the observed urinary DINCH metabolite concentrations from 3 volunteers, with a Pearson correlation coefficient of ~0.75. We showed the importance of a "holding" reservoir, called for convenience in our model the L compartment. Without it, a good agreement could not be found for data points later in the experiment; only by holding up metabolism by a deposition into this reservoir could these later data points be well simulated.

Abstract Number	**P-3-24-02**
Presenter	Hyo-Mi Kim*, Kyong-Whan Moon, Seong-Do Yu, Jong-Tae Lee
Exposure	organic compounds
Health domains	no health domain
Type of research	others

An analysis study of the exposure factors from an environmental hazardous material (1-hydroxyperene)

BACKGROUND Polycyclic aromatic hydrocarbons (PAHs) are composed more than two benzene rings that are formed by incomplete combustion of organic materials or the process of high-pressure. PAHs has potential carcinogenic and/or mutagenic properties. 1-Hydroxypyrene, the metabolite of pyrene, is used to assess the exposure of polycyclic aromatic hydrocarbons (PAHs). AIMS In this study, we analyzed the PAHs exposure levels of Korean adults participating to “Korean National Environmental Health Survey”, using the urinary 1-OHP levels as a biomarker for PAHs, and evaluated the exposure factors that closely associated with the level of urinary 1-OHP. METHODS We used log transformed urinary 1-OHP (log(1-OHP)) value as a dependent variable for analysis of the association with exposure factors. Multiple linear regression and logistic regression model were used to evaluate the relationship between log(1-OHP) and exposure factors. RESULTS In a multiple analysis, we observed that 1-OHP was significantly associated with variables including age group, education, smoke, drink, heating source, distance from the road, and charcoal grilled or roasted meet consumption. Results from multiple logistic regression analysis, we observed significant finding with variables including gender(male OR:1.53 (95% CI:1.02,2.31), education (above college OR:0.32 (95% CI:0.18,0.54) and smoke (current smoker OR:17.73 (95% CI:11.02,28.51). We evaluated the association between traffic related air pollution factors (use of public transportation, type of transportation and distance from the road) and log(1-OHP), however, only distance from the road was significantly associated with log(1-OHP) CONCLUSIONS The analysis shows that the factors, such as smoking habit, gender and charcoal grilled or roasted food consumption are significantly associated with log(1-OHP). These results may provide a supportive evidence of the finding from previous studies. These analysis results can be used as reference for policy making for reducing environmental hazardous materials.

Abstract Number	**P-3-24-03**
Presenter	Andrea Winquist*, Kyle Steenland
Exposure	persistent organic pollutants
Health domains	cardiovascular disease
Type of research	cohort study

Association between cumulative PFOA exposure and coronary artery disease, hypertension and high cholesterol in community and worker cohorts

Background: This study is part of a series of C8 Science Panel studies of a Mid-Ohio Valley population with substantial perfluorooctanoic acid (PFOA) exposure due to living near a chemical plant. Several previous studies have found associations between PFOA exposure and high cholesterol, but studies of associations with coronary artery disease (CAD) have had inconsistent findings. Aims: This study examined the association between PFOA exposure and incident CAD or CAD risk factors (hypertension (HTN) and high cholesterol (HCHOL) with medication) among plant workers and community residents. Methods: Community- and worker-cohort participants completed surveys during 2008-2011 covering demographics, health-related behaviors, and medical history. Cox proportional hazard models, stratified by birth year, modeled the hazard of each outcome (starting at age 20) as a function of time-varying cumulative exposure (CE, sum of yearly serum PFOA concentration estimates generated through fate, transport and exposure modeling), controlling for gender, race, education, smoking, alcohol use, body mass index, and diabetes. Results: The analysis included 32,254 participants (28,541 community; 3,713 worker), of whom 3,147 reported CAD (2550 confirmed), 12,325 reported HTN with medication, and 9,909 reported HCHOL with medication. The incidence of HCHOL with medication increased with increasing cumulative PFOA exposure, most notably among males aged 40-60 years. Compared with the lowest CE quartile (<142 ng/ml-years), hazard ratios for subsequent quartiles (ng/ml-years: 142-234; 234-630; 630-3579; 3579+) were 1.24, 1.17, 1.19 and 1.19 overall (test for positive trend =0.005) and 1.38, 1.32, 1.31, and 1.44 (p-value for positive trend <0.001) among men aged 40-60 years. There was no apparent association between PFOA exposure and HTN or CAD incidence. Conclusions: Higher PFOA exposure was associated with incident HCHOL with medication, but not with HTN or CAD.

Abstract Number	**P-3-24-04**
Presenter	Kyungho Choi*, Sunmi Kim, Jeongim Park, Hae-Joong Kim, Jeongjae Lee, Gyuyeon Choi, Sooran Choi, Sungjoo Kim, Suyoung Kim, Hyo-Bang Moon, Sungkyoon Kim
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Association between several persistent organic pollutants and thyroid hormone levels in serum among the pregnant women of Korea

Persistent organic pollutants such as polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and organochlorine pesticides (OCPs) are of global concern because of their widespread contamination and adverse health effects. Potential endocrine disruption, especially of thyroid status by PCBs has been repeatedly suggested in both experimental and epidemiological studies. However the associations with PBDEs or OCPs have been arguable especially in human populations. We investigated the associations between major groups of POPs and thyroid hormone balances among pregnant women. One hundred thirty eight pregnant women at delivery were recruited from four cities of Korea in 2011. Blood samples were collected within a day before delivery. Serum was then analyzed for 19 PCBs, 19 PBDEs, and 19 OCPs, along with five thyroid hormones (free and total T3 and T4, and TSH). Several PCBs such as PCB28, 118, 138, or 153 showed either negative associations with T3 or T4, or positive associations with TSH. BDE47 and total PBDEs showed negative associations with T3 or T4, or positive associations with TSH, even when the effects of PCBs were adjusted. For OCPs, while the associations were rather inconsistent and insignificant, chlordanes (CHDs) and hexachlorobenzene (HCB) were generally associated with reduction of T3 or T4, or increase of TSH. Although the thyroid hormone levels of all the subjects were within the reference range, exposure to PCBs and PBDEs were clearly related with potential for disrupting thyroid hormone balance among pregnant women, at the current level of exposure. Although subtle, the changes in thyroid hormones should be seen with caution because even minor changes within pregnant women may have significant consequences especially on sensitive population like fetus.

Abstract Number	**P-3-24-05**
Presenter	Beatriz Valera*, Pierre Ayotte, Paul Poirier, Eric Dewailly
Exposure	persistent organic pollutants
Health domains	cardiovascular disease
Type of research	cross-sectional study

Associations between persistent organic pollutants and blood pressure in a native population of Quebec (Canada)

Background: Recent evidence suggests that exposure to persistent organic pollutants (POPs) increase the risk of hypertension in environmentally exposed populations. High POP levels have been detected in Arctic populations and the exposure is related to high consumption of fish and marine mammals, which represents the traditional diet of these populations. Aim: We examined the associations between polychlorinated biphenyls (PCBs), organochlorine (OC) pesticides and hypertension among Inuit from Nunavik (Quebec, Canada). Methods: A complete set of data was obtained for 315 Inuit ≥ 18 years who participated in the "Santé Quebec" health survey that was conducted in the 14 villages of Nunavik. Fourteen polychlorinated biphenyls (PCBs) and 8 OC pesticides or their metabolites were quantified in plasma samples using a gas chromatography method. Blood pressure (BP) was measured using a standardised protocol and information regarding anti-hypertensive medication was obtained through questionnaires. The associations between log-transformed POPs and hypertension (systolic BP ≥ 140 mm Hg, diastolic BP ≥ 90 mm Hg or anti-hypertensive medication) were analyzed using multiple logistic regressions. Results: Total PCBs as well as the sum of non-dioxin-like PCBs were significantly associated with higher risk of hypertension. Furthermore, the risk of hypertension increased with higher plasma concentrations of congeners 101, 105, 138 and 187. Regarding OC pesticides, p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) was associated with increased risk of hypertension while inverse associations were observed with p,p'-dichlorodiphenyltrichloroethane (p,p'-DDT), β-hexachlorocyclohexane (HCH) and oxychlordane. Conclusions: Some PCB congeners were associated with higher risk of hypertension in this highly exposed population. However, the analyses of OC pesticides revealed divergent results, which need to be confirmed in further cohort and experimental studies.

Abstract Number	**P-3-24-06**
Presenter	Megan Horton*, Xinhua Liu, Richard Jones, Andreas Sjodin, Robin Whyatt, Ronald Wapner, Pam Factor-Litvak*
Exposure	persistent organic pollutants
Health domains	neurodevelopment
Type of research	cohort study

Associations between prenatal exposure to polybrominated flame retardants and infant birth outcomes

Background Polybrominated diphenyl ethers (PBDEs) are added to consumer products to reduce flammability. PBDEs leach from products into the environment resulting in considerable human exposure. Maternal exposure to PBDEs is associated with disrupted maternal thyroid function, and altered behavior and reduced scores on intelligence tests in offspring. We examined associations between prenatal exposure to PBDEs and pregnancy outcomes among healthy pregnant women living in New York City. Methods Between 2009-2010 we recruited 275 women during the first half of pregnancy, administered a prenatal exposure questionnaire and collected maternal serum samples. Pregnancy outcomes were abstracted from newborn medical records. 12 PBDE congeners including PBDE-47, -99, -100 and -153 were measured serum. Values < LOD were substituted with LOD/√2. PBDE-47, -99 and -100, were highly correlated (Spearman's r > 0.80), thus summed (ΣPBDE). Linear regression was used to estimate associations between ΣPBDE or PBDE-153 and birth outcomes. Control variables include prepregnancy BMI, mothers race/ethnicity, and cigarette smoking during pregnancy. Results PBDE-47, -99, -100 and -153 were widely detected in maternal serum samples (99%, 83.5%, 91%, and 98.4%, respectively). Mean gestational age, birth weight, length, and head circumference were 39.2 (range 24-44) weeks, 3336 (+ 491.7 standard deviation) grams, 50.7 (2.8) cm and 34.1 (2.5) cm, respectively. The highest quartile of ΣPBDE (compared to all other categories) was weakly associated with birth weight (estimated β = 109.3, 95% confidence interval (CI) -11.4, 230.0), birth weight percentile (5.4 (-2.5, 13.4)) and significantly associated with increased birth length (0.97 (0.30, 1.64)). The highest decile of PBDE-153 (compared to all other categories) was associated with modest increases in birth length (0.70 (-0.27, 1.68)) and birth weight (110.5 (-65.0, 286.0)). Conclusion In this population, specific PBDEs may be associated with increases in infant anthropometric measures.

Abstract Number	**P-3-24-07**
Presenter	Jin Ma*, Xinghua Qiu
Exposure	persistent organic pollutants
Health domains	no health domain
Type of research	others

Dechlorane Plus in Surface Soil of North China

Dechlorane Plus in Surface Soil of North China Jin Maa,, Xinghua Qiub aState Key Laboratory of Environmental Criteria and Risk Assessment, Chinese Research Academy of Environmental Sciences, Beijing 100012, China bState Key Joint Laboratory for Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing 100871, China Background Dechlorane Plus (DP) was recently identified as an environmental pollutant.However, information on DP in environmental materials was very limited in China. Aims In order to provide a better understanding of the fate, sources and spatial distribution of DP in soils of North China. Methods 87 soil samples collected from North China were analyzed for DP, and ordinary kriging was undertaken to map the spatial patterns. Results DP was detected in 85 samples, the concentrations ranged from not-detectable (ND) to 12.21 ng/g with a mean of 0.55 ng/g. The mean concentrations of DP in four regions of North China were in the following order: Jingjin (Beijing and Tianjin)＞Shandong＞Shanxi＞Hebei.The mean fsyn values for Jingjin (0.27), Hebei (0.24), and Shanxi (0.24) were close to 0.25, while the mean fsyn value for Shandong (0.31) was closer to 0.35. The fsyn value for Shandong was significantly higher (P < 0.01) than those of other regions, indicating specific sources of DP.Syn-DP displayed a strong linear relationship with anti-DP (R2 = 0.74), indicating no obvious stereoselective process occurred. Relatively high concentrations of DP in soils were present in south of Shanxi, central Hebei, south of Tianjin, and the south and northeast of Shandong. Conclusion DP was extensively detected in soils of North China with low concentrations. Shandong province was suggested to have different sources with other regions. Relatively high concentrations of DP in soils were suggested to be connected with human activities such as e-waste dismantling.

Abstract Number	**P-3-24-08**
Presenter	Janie Shelton*, Todd A. Jusko, Irva Hertz-Picciotto
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Gestational DDT and DDE concentrations and cognitive outcomes at age 5 in the Child Health and Development Study

Background: Gestational exposure to DDT, a persistent pesticide banned in many western countries but used widely elsewhere for mosquito control, has been associated with lower performance on tests of cognitive function and development among children, although findings have been mixed. Aims: To evaluate the role of DDT and DDE during peak usage in the United States on children's cognitive function at 5-years of age. Methods: We used a subsample (N=399) of mother-child pairs from the Child Health and Development Study, a prospective birth cohort study conducted in the 1960's in Northern California, to evaluate the association between maternal serum concentrations of lipid-adjusted concentrations of DDT and DDE (µg/g) and cognitive scores at 5-years of age in linear regression models. Cognitive performance was measured by standardized scores on the Raven's Progressive Matrices and the Peabody Picture Vocabulary (PPV). Both tests had a standard deviation of 10 points. Results: In models adjusted for confounders and maternal PCB concentrations, the highest quartiles of p,p-DDE, and p,p-DDT corresponded with an average loss of 6 and 4 points on the Raven's test (60% and 40% of a standard deviation), compared to the lowest quartile (reference). On scores for the Peabody test, children born to mothers with the highest quartile of p,p-DDT concentrations had an average loss of 3.5 points (35% of a standard deviation) compared to the lowest quartile. Conclusions:Women working in industries with DDT exposure or who live in areas with indoor residual DDT spraying may be at risk of achieving exposures high enough to impact their child's cognitive performance. Additional routes of exposure in countries with longstanding DDT bans include consumption of fatty meats and food imported from areas where DDT is still in use, which are both modifiable dietary risks.

Abstract Number	**P-3-24-09**
Presenter	Marilyn Black*
Exposure	organic compounds
Health domains	healthrelated quality of life
Type of research	exposure measurement

Historical Change in Product Emissions and Indoor VOCs

Indoor air quality is impacted by the presence of VOCs. Indoor environments contain anywhere from 200-600 different measurable VOCs at any one time with many known odorants, irritants, carcinogens, or reproductive toxins. Sources include furnishings such as furniture and flooring; construction/remodeling materials including adhesives, paints and sealants; cleaning supplies and personal care items; and electronic equipment including computers, laser printers, and photocopiers. With the recognition of poor indoor air quality and the role of elevated VOCs, source control is a key prevention strategy. Early in the 1990's, manufacturers began to study emissions from their products and identify mechanisms for reducing total mounts of VOCs and eliminating those with known toxicity. In the United States, the state of Washington's East Campus Plus program was one of the first construction programs to implement a product emission standard for all products to be used in commercial buildings. With that project, hundreds of different materials were tested for their emissions and documented. Over 20 years later, the database of emissions information measured using environmental chambers has increased to tens of thousands including those of "green", low emitting products tested to meet emission standards meeting GREENGUARD requirements and green building specifications as California 1350, the national Collaborative for High Performance Schools Program (CHPs), and green building rating systems. A review of emissions from key products including furniture, flooring, paints, insulations, and printers will be demonstrated as to their VOC characteristics and how these have trended overtime. The data when compared with VOC building data show: 1) the significance of cleaning chemicals as primary sources in schools; and 2.) that construction material and furnishing VOCs dominate in commercial and residential spaces with frequent elevated levels in today's "green" and energy efficient buildings.

Abstract Number	**P-3-24-10**
Presenter	Erica Lee*, Katrina Kezios, Xinhua Liu, June-Soo Park, Darcy Tarrant, Yunzhu Wang, Myrto Petreas, Piera Cirillio, Barbara Cohn, Pam Factor-Litvak
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Levels of hydroxylated polychlorinated biphenyls (OH-PCBs) and thyroid function in pregnant women

Background Polychlorinated biphenyls (PCBs) are persistent contaminants. PCBs are metabolized into hydroxylated metabolites (OH-PCBs) now considered possibly more toxic than the parent compounds. Because PCBs may be associated with perturbed thyroid function, we examined the relationship between five OH-PCBs and thyroid function in pregnant women. Aims To examine the relationship between five OH-PCBs and 3 measures of thyroid function in pregnant women. Methods Stored postpartum sera from 442 pregnant women from the Child Health and Development Studies were analyzed for five OH-PCBs (4-OH-CB107, 3-OH-CB153, 4-OH-CB146, 3'-OH-CB138 and 4-OH-CB187) and stored second trimester sera were analyzed for free thyroxine (FT4), thyroid stimulating hormone (TSH) and thyroid peroxidase antibodies (TPOAb). Spearman correlation (r) was used to examine the bivariate associations between each OH-PCB and each measure of thyroid function. Linear regression was used to examine the associations adjusting for potential confounders. Results Median concentrations of 3-OH-CB153, 4-OH-CB146, 3'-OH-CB138were all 0.03 ng/ml. Median levels of 4-OH-PCB107 and 4-OH-CB187 were higher; at 0.08 ng/ml and 0.38 ng/ml, respectively. Mean (+ sd) concentrations of free T4, TSH, and ATPO were 1.26 (+0.21) ng/dl, 1.49 (+1.09) uIU/ml, and 28.9 (+76.6) IU/ml, respectively. Parent-compound and metabolites were correlated at 0.152-0.398. We found positive associations between 4-OH-CB107 and FT4 (estimated regression coefficient b = 0.030, p =.029), and between TSH and both 4-OH-CB187 (b = 0.099, p =.029), and 3-OH-CB153 (b = 0.065, p =.033). Conclusions Levels of OH-PCBs were consistent with reported literature. We found small associations between selected OH-PCBs and FT4 and TSH, suggesting that OH-PCBs are associated with maternal thyroid status. Exposure may result in adverse outcomes in the developing fetus, and emphasize the need for research on long term outcomes associated with PCB exposure and thyroid dysfunction.

Abstract Number	**P-3-24-11**
Presenter	Lubica Palkovicova*, Henrieta Patayova, Kinga Lancz, Katarina Rausova, Sona Wimmerova, Jana Chovancová, Eva Šovcíková, Tomáš Trnovec
Exposure	persistent organic pollutants
Health domains	obesity
Type of research	cohort study

Levels of leptin and adiponectin in children environmentally exposed to PCBs

Background Adipocytes secrete metabolically active proteins known as adipokines, the major ones being leptin and adiponectin. Leptin is the regulator of food intake and energy expenditure at the hypothalamus level, it affects metabolically active tissues and several neuroendocrine axes. Adiponectin is one of the key molecules in metabolic syndrome, it regulates insulin sensitivity and hepatic glucose production. There is raising concern about the influence of chemical exposures on obesity and the role of environmental exposure to endocrine disruptors in the alteration of human metabolism. Aims To asses the effect of environmental exposure to polychlorinated biphenyls (PCBs) on the levels of leptin and adiponectin in 7-year-old children. Methods Children, living in the area of Eastern Slovakia contaminated by PCBs, were followed from birth up to 7 years of age. At the age of 7 years, levels of leptin and adiponectin were measured in blood samples (N=267) using ELISA. Eleven PCB congeners in cord blood and at the age of 6 years were analysed by HR-GC. Multiple linear regression was used for assessment of the association between prenatal and current PCB exposures and the levels of adipokines. Results Median (average±SD) levels of leptin and adiponectin in 7-year-old children were 2.267 (6.04±9.28) ng.ml-1 and 7.21 (7.89±3.97) mg.ml-1, respectively. Actual weight of a child represented a strong predictor for leptin (r=0.64, p<0.001), but not for adiponectin levels. Regression model adjusted for ethnicity and gender showed negative association of leptin levels with current PCB exposure. Adiponectin levels were inversely associated with cord blood PCBs but this relationship disappeared after adjustment for other variables. Conclusions Our findings support the hypothesis that exposures to endocrine disruptors in infancy interfere with metabolic pathways. Acknowledgements: 7th FP EU project OBELIX (no. 227391)

Abstract Number	**P-3-24-12**
Presenter	P Barry Ryan*, Tippawan Prapamontol, Parinya Panuwet, Ampica Mangklabruks, Surat Hongsibsong, Sompong Loayang, Warangkana Narksen, Niphan Srinual, Anne M. Riederer, Dana Boyd Barr
Exposure	pesticides
Health domains	neurodevelopment
Type of research	cohort study

Maternal Urinary Dialkylphosphate Metabolites of Organophosphorus Insecticides in a Pilot Birth Cohort in Thailand: The SAWASDEE Study

Female agricultural workers in Northern Thailand are exposed to higher levels of pesticides. Exposures experienced by these women before and during pregnancy may lead to neurodevelopmental delays in their offspring. Our objective was to recruit fifty Thai female agricultural workers and evaluate their pesticide exposures during pregnancy through measurement of urinary levels of dialkylphosphates, metabolites of organophosphorus insecticides, which are commonly used in Northern Thailand. Fifty-six pregnant women in Chiang Mai Province in Northern Thailand were recruited for this study during their first and second trimesters of pregnancy. Spot urine samples were collected from participants during each prenatal visit with individual participants supplying a minimum of five and as many as thirteen samples. The urine samples were analyzed at an internationally certified laboratory in Thailand for dialkylphosphates using gas chromatography and nitrogen-phosphorus detection. Summed total dialkylphosphates averaged 374.0 nmol/L over the 56 women, but with substantial between-woman variability (sd = 394.8 nmol/L). Similar values (332.3 ± 384.0 nmol/L) were observed for summed diethyl alkylphosphates. Summed dimethyl alkylphosphates were substantially lower averaging 41.7 ± 66.6 nmol/L. Estimating samples size needed to estimate the mean within 50% for the various measures ranged from about 2 samples to about 10 samples, assuming log-normal distributions. Analyses also indicate statistically significant variability across seasons and between pregnancy trimesters each accounting for approximately 2% of the variance in summed total dialkylphosphates However, inter-individual variability dominates overall, accounting for approximately 20-25% of the total variance in the summed urinary concentrations. Models including inter-individual variability, seasonal variability, and trimester variability indicate that each of these variables is significant, even when accounting for the others.

Abstract Number	**P-3-24-13**
Presenter	Srishti Srestha, Michael Bloom, Edward Fitzgerald*
Exposure	persistent organic pollutants
Health domains	other
Type of research	cross-sectional study

Perfluorinated Compounds and Thyroid Function in Older Adults

Background: Perfluorinated compounds (PFCs) are widespread. PFCs may disrupt thyroid function; however, the human evidence is equivocal. Objectives: We assessed 1) predictors of serum perfluorooctanoic acid (PFOA) and perfluorooctane sulphonate (PFOS), and 2) associations between thyroid hormones and serum PFOA and PFOS among older men and women. Methods: Serum PFC levels were measured in 157 participants aged 55 -74 years. We used demographic variables and occupational information to identify predictors of serum PFOA and PFOS. We examined associations of serum PFOA and PFOS with serum thyroid stimulating hormone (TSH), free thyroxine (FT4), total thyroxine (T4), and total tri-iodothyronine (T3) in a subsample of men (n=51) and women (n=36) who were not taking sex hormones or thyroid medications. Linear regression models were used for both aims. Serum PFOA, PFOS, and TSH were log-natural transformed. Results: Geometric means (SD) of serum PFOS and PFOA were 34.2 (1.8) and 8.1 (1.7) ng/ml respectively, higher than the levels in NHANES 2003-2004 for men and women of the same age (22.8 (2.1) for PFOS and 3.9(2.1) for PFOA). Serum total PCB (lipid basis (ppb),p=0.02), occupational lead exposure (p=0.09), and low income (p<0.01) were predictors of PFOS; occupational solvent exposure (p=0.08), blood mercury (ng/dl, p=0.06), and area of residence (p=0.02) were PFOA predictors. Specific industries that were associated with elevated PFOS or PFOA included pulp and paper, color, chemical, and plastic manufacturing, military personnel, and general construction. Regarding thyroid biomarkers, PFOS was positively associated with both FT4 (β = 0.06, p=0.09) and T4 (β =0.87, p<0.01) adjusting for relevant confounders. These associations were stronger among women and older persons. Conclusion: The elevations in serum PFCs in this population appear to be related to occupation and are associated with increases in certain markers of thyroid function.

Abstract Number	**P-3-24-14**
Presenter	Atsuko Araki*, Toshio Kawai, Tazuru Tsuboi, Yu Ait Bamai, Eiji Yoshioka, Shuji Tajima, Shigekazu Ukawa, Cong Shi, Reiko Kishi
Exposure	organic compounds
Health domains	allergies
Type of research	cross-sectional study

Phthalate metabolites in urine and their relation to asthma and allergy in school children -Exposure assessment to plasticizer and flame retardants (3)

Background: Phthalates are widely used as a plasticizer. Exposure to phthalates has been concerned to cause allergies. Aims: To determine the levels of phthalate metabolites in urine and to find their relation to the prevalence of asthma and allergies in children. Phthalate anhydrate and 2-ethyl-1-hexanol (2EH) were also examined as markers of DEHP and sum of total phthalate exposures, respectively. Methods Urine samples were collected from 182 elementary school children in Sapporo, Japan. Seven Metabolites (MEHP, 5oxo-MEHP, 5cx-MEPP, MEP, MiBP, MBzP, and DCPP), phthalate anhydrate, and 2EH were analyzed by GC/MS(SIM). Prevalence of allergies was determined using ISAAC questionnaire. Results: The prevalence of asthma, allergic rhino-conjunctivitis, and atopic dermatitis was 21.2%, 29.3% and 29.3%, respectively. Median values of creatinine adjusted metabolites were MEHP 21.5µg/gCr (detection rate 82.4%), 5oxo-MEHP 50.1µg/gCr (99.5%), 5cx-MEPP 30.9µg/gCr (92.3%), MiBP 41.4µg/gCr (96.7%), MBzP 14.88µg/gCr (80.8%). Detection rates of MnBP and MCPP were lower than 50%, and therefore, no further analysis was conducted. Median levels of 2EH and phthalate anhydrate were 54.6µg/gCr and 78.4µg/gCr, respectively, and detected from all samples. Correlation between 2EH and sum of 3 DEHP metabolites, phthalate anhydrate and sum of 7 metabolites were significant but the correlation coefficient were not high. For both crude and adjusted models (gender, grade and parental history of allergies), there was no relation between allergies and any of metabolites as well as 2EH and phthalate anhydrate. Conclusions: Although the level of MBzP was higher among the subjects in this study than in Taiwan study, there was no relation between MBzP and asthma as in previous study. The inconsistent result may be due to the definition of the outcome, or the subjects in Taiwan study were younger and thus more valuable to the exposure. The study was supported by Environment Research and Technology Development Fund (C-1151).

Abstract Number	**P-3-24-15**
Presenter	Mireia Gascón*, Jordi Sunyer, Cécile Chevrier, Merete Eggesbø, Eva Govarts, Monika Kasper-Sonnenberg, Lubica Palkovicova, Maties Torrent, Maria Vassilaki, Maribel Casas, Martine Vrijheid
Exposure	persistent organic pollutants
Health domains	respiratory disease
Type of research	meta-analysis

Prenatal exposure to DDE and PCB153 and infant's respiratory health: A European study

Background Recent epidemiological data suggest that early-life exposure to persistent organic pollutants can adversely influence immune and respiratory system development, but epidemiological evidence is still limited. Aims To study the association between prenatal exposure to DDE and PCB153 and occurrence of respiratory symptoms in children from 10 European birth cohorts participating in the CHICOS and ENRIECO projects. Methods A total of 4483 children with information on PBC153 and DDE exposure and at least one respiratory health outcome were included: bronchitis, wheeze and acute otitis media before two years of age and wheeze over two years of age. As cohorts measured DDE and PCB153 in different matrixes (maternal or cord blood and breastmilk), conversion factors were applied to harmonize exposure to cord blood levels. We performed random effects meta-analyses using Poisson regression models. Exposure was introduced as a continuous variable (log transformed) and comparing high versus low (tertile) categories. Results DDE and PCB153 exposure as continuous were associated with bronchitis [RR per log unit increase of ng/L exposure (95%CI)=1.08 (1.00,1.16) and 1.09 (1.01,1.18), respectively]. Similar results were found when comparing high versus low exposure groups. However, in this case the risk of wheeze below two years was increased [RR highest vs lowest tertile: 1.17 (1.03,1.33)]. There were no associations with wheeze over two years or acute otitis media. Results obtained for DDE exposure were robust to the exclusion of one cohort at the time, whereas PCB153 results were more driven by one highly exposed cohort. Conclusions This meta-analysis, studying the largest number of children thus far, suggests that prenatal DDE and PCB153 exposures may be associated with respiratory health symptoms in young children. Harmonization of outcome assessment is important in order to facilitate pooling of data in further follow-ups at older ages. This would allow a better assessment of long-term effects of these exposures.

Abstract Number	**P-3-24-16**
Presenter	Damaskini Valvi*, Michelle A Mendez, Ferran Ballester, Jesús Ibarlucea, Fernando Goñi, Joan O. Grimalt, Esther Vizcaino, Jordi Sunyer, Martine Vrijheid
Exposure	persistent organic pollutants
Health domains	obesity
Type of research	cohort study

Prenatal exposure to persistent organic pollutants and early postnatal growth: Prospective evidence from the Spanish INMA-birth cohorts

Background: The "environmental obesogen hypothesis" postulates that chemical exposures, especially if they occur in utero, may influence adipogenesis and lipid storage and metabolism and thus, may increase the risk of obesity. This hypothesis has scarcely been explored in humans. Aim: We examined the effects of prenatal exposure to persistent organic pollutants (POPs) on rapid growth in the first 6 months of life and subsequent overweight at 14 months of age. Methods: Pregnant women were recruited to the Spanish INMA prospective birth cohorts between 2003-08. The POPs dichlorodiphenyldichloroethylene (DDE), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs - congeners 153, 138, 180) were measured in maternal pregnancy serum. Rapid growth was defined as a z-score weight gain > 0.67 SD between 6 months of age and birth. Infant overweight at 14 months was defined as a BMI z-score ≥ the 85th percentile (WHO referent). Generalized linear models examined the association between POPs and rapid growth (N=1285) and overweight (N=1198). Results: The analysis population included 24% (N=311) rapid growers and 30% (N=358) overweight infants. DDE and HCB were associated with rapid growth [adjusted RR (95% CI) per log ng/g lipid increase=1.13(1.01-1.26) and 1.13(1.00-1.29), respectively] and with overweight [adjusted RR (95% CI)=1.15(1.03-1.28) and 1.19(1.05-1.34), respectively]. There was an indication that infant sex and exclusive breastfeeding duration may modify the effects of DDE, and that maternal prepregnancy BMI status may influence the effects of HCB. PCBs were unrelated to postnatal growth. Multipollutant adjustment for all POPs did not affect findings. Conclusions: This study, the largest prospective analysis to date on this topic, suggests that prenatal exposure to DDE and HCB influence postnatal growth very early in life. Further studies are needed to confirm these findings in different settings and to evaluate their persistence at older ages.

Abstract Number	**P-3-24-17**
Presenter	Hsiu Ying Ku*, Shu-Li Wang, Pei Lin Wang, Pen Hua Su, Chien Jen Wang, Pao Chi Liao, Hsiao-Yen Chen
Exposure	persistent organic pollutants
Health domains	neurobehavioral effects
Type of research	cohort study

Prenatal exposure to phthalate esters and children's temperament

Background: Previous studies have reported that phthalates exposure affect the development of behavior problems with limited information on personality. Aims: Our goal was to examine the association between prenatal exposure to phthalates and the children temperament . Methods:We recruited 430 pregnant women without complications from the general population in central Taiwan during 2000.11 ~ 2001.11. Urinary samples were collected during the third trimester. The children have been followed for temperament (Thomas and Chess) at 2-3 and 5-6 years old. Seven urinary phthalate metabolites representing the exposure to most frequently used five phthalate esters (DMP, DEP, DnBP, BBzP and DEHP) were measured by LC–ESI-MS/MS. Results:Maternal urinary MMP, MEP, MnBP, MBzP and MEHP concentrations were positively correlated with distractibility (i.e. β= 0.35 for MEHP, $p<0.05$) and lower intensity of reaction (β= -0.28, $p<0.05$) in boys aged 2-3 years, after adjustment for parental education, parity, parenting style , and Bayley scores at 2 years. Similarly, pregnan women with higher MMP, 5OH-MEHP and 5oxo-MEHP metabolite concentrations were associated with lower intensity of reaction (i.e. β= -0.68 for MMP, $p<0.05$) in boys aged 5-6 years. We also found that children persistence scores decreased with increasing maternal DEHP exposure (β= -0.38, $p<0.05$) in 2-year-old boy. Among girls, higher prenatal exposure to DMP and BBzP were associated with higher levels of social withdrawal at 5-6 years (β= 0.64; β=0.70, $p<0.05$respectively). There was less extent of the relation to postnatal exposure. Conclusions:Our findings suggest prenatal exposure to phthalates were likely to affect the children personality with different pattern for boys and girls.

Abstract Number	**P-3-24-18**
Presenter	Christopher Ronk, Dana Hollins, Megan Jacobsen, David Galbraith, Heather Bolstad*, Dennis Paustenbach
Exposure	organic compounds
Health domains	respiratory disease
Type of research	cross-sectional study

Pulmonary Obstruction among Workers at a Food Flavorings Manufacturing Facility

Objective: Pulmonary obstruction, characterized by an abnormally low FEV1 value along with a low FEV1/FVC ratio, has been studied for a possible association with occupational exposure to food flavorings. To further evaluate a potential link between flavorings and obstruction, we examined the prevalence of obstruction at a U.S. food flavorings manufacturing facility. Methods: Spirometry was conducted between 1998 and 2009 for 107 workers at the flavorings manufacturing facility. A prevalence odds ratio was estimated to compare the prevalence of obstruction at the facility to an expected value estimated from NHANES III. The prevalence odds ratio was adjusted for age (younger than 40 or 40 and older), gender, race/ethnicity, smoking status (ever smoker, yes/no) and body mass index (BMI; less than 25 kg/m2, 25 to less than 30 kg/m2, or greater than or equal to 30 kg/m2) at time of most recent pulmonary function test. A 95% CI for the resulting prevalence odds ratio was determined by the Byar method. Results: Of the 107 workers studied, 3 (2.8%) demonstrated a pattern of pulmonary obstruction on their most recent spirometry test. One additional worker demonstrated a mixed obstructive/restrictive pattern. The corresponding prevalence odds ratio for the relative prevalence of obstruction was 0.41 in this population (95% CI: 0.08–1.20) with 7.29 cases of an obstructive pattern expected using the NHANES III cohort. Conclusions: The prevalence of obstruction within this group of flavorings workers was consistent with the expected number of cases in the general population. Generalizing these results should be performed in the context of sample size considerations. However, this cohort represents one of the larger flavorings manufacturing facility cohorts studied to date.

Abstract Number	**P-3-24-19**
Presenter	Fung-Chang Sung*, Wen-Chao Ho, Jin-Hua Chen, Chung-Fen Lin, Min-Huei Su
Exposure	persistent organic pollutants
Health domains	cancer
Type of research	review

Systemic Study on Association between Dioxin and Liver Cancer

Background. Animal study has shown that dioxin-sensitive rats exhibit significant transcriptional heterogeneity in hepatic responses to 2,3,7,8-tetrachlorodibenzo-p- dioxin (TCDD). There are many studies on the association between the dioxin exposures and human cancers, but with conflict results including studies for liver cancer as well. A meta-analysis may evaluate the association. Aims. For this systemic review, we search for studies published in the recent 2 decades that reported the association between dioxin exposures and liver cancer risks. Methods. We searched Pubmed and Medline for reports published in journals in English using key words limited to 2,3,7,8-tetrachlorodibenzo-p-dioxin, TCDD, human exposure, liver cancer, liver cancer cell proliferation and hepatic neoplastic development. We identified 5 studies with relative risks (RRs) of liver cancer or liver cancer mortality measured by exposure levels assessed based on place of residence for general population and farmers, and for males and females. Results. Compared with residential areas of the lowest exposure levels, none of the reported 21 RRs of liver cancer or liver cancer mortality for residents with higher exposures were significant, ranging from 0.0 (95% CI 0.0-3.9) to 1.3 (95% CI 0.3-3.8). Conclusions. Residents living in the high exposure areas are not at a higher risk of liver cancer or mortality from liver cancer. The pathway of human exposure to dioxin based on the place of residence is not clear. The exposure levels are probable not high enough to assess the causal relationship. Keywords: Dioxin, liver cancer, relative risk, systemic study.

Abstract Number	**P-3-24-20**
Presenter	Ami Zota*, Antonia M. Calafat, Tracey Woodruff
Exposure	others
Health domains	no health domain
Type of research	others

Temporal Trends in Exposure to Phthalates: Findings from the National Health and Nutrition Examination Survey 2001-2010

Background: Phthalates are ubiquitous environmental contaminants and some may adversely affect human health. Butylbenzyl phthalate (BBzP), di-n-butyl phthalate (DnBP), and di(2-ethylhexyl) phthalate (DEHP) are being phased out and replaced by substitutes including di-iso-nonyl phthalate (DiNP), and di-iso-decyl phthalate (DiDP), however little is known about consequent trends in population-level exposures. Aims: To examine temporal trends in urinary concentrations of phthalate metabolites in the US general population, and whether trends vary by age, sex, race/ethnicity, or income. Methods: We combined data on 11 phthalate metabolites for 8626 participants from 2001-2002, 2003-2004, 2005-2006, 2007-2008, and 2009-2010 cycles of the National Health and Nutrition Examination Survey. We compared least square geometric mean (LSGM) concentrations of phthalate metabolites by cycle after creatinine adjustment. Results: LSGM concentrations of metabolites of diethyl phthalate (DEP), DnBP, BBzP, and DEHP decreased between 2001-2002 and 2009-2010 (Ptrend < 0.05). The percent decrease in LSGM concentrations ranged from 20% for the DnBP metabolite to 50% for the DEP metabolite and the molar sum of DEHP metabolites (∑DEHP metabolites). In contrast, LSGM concentrations of metabolites of di-iso-butyl phthalate (DiBP), DiNP, and DiDP increased 220%, 160%, and 20%, respectively, over the study period (Ptrend < 0.05). Trends varied by age, sex, race/ethnicity, and income (Pinteraction < 0.05). For example, DEHP, DiNP, and DiDP metabolites were higher in children than adults but the gap between the groups narrowed over time. Conclusions: US population exposure to phthalates has changed in the last decade. These trends likely reflect shifts in commercial formulations, public awareness, and regulations.

Abstract Number	**P-3-24-21**
Presenter	Chang Wei Hsiang*, Li Sih Syuan, Pan Hsien An, Wu Meng Hsing, Kuo Pao Lin, Lee Ching Chang
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	case-control study

The association between phthalates exposure and serum reproductive hormones in Taiwanese fertile and infertile men

Background: Phthalates have demonstrated the adverse effects on androgen-regulated reproductive function in animals. Epidemiological studies have reported inconsistent evidences between phthalates exposure and human reproductive function, including reproductive hormones and semen quality. Aims: To investigate the general exposures of Taiwanese fertile and infertile menand estimate the potential effects on reproductive functions. Methods:This case-control study was carried out from 2010 through 2012. 139 men were recruited through infertility clinics and 25 men were recruited form obstetrics clinics.After signing informed consents, urine, serum and semen samples were collected. Urinary phthalate monoesters and secondary metabolites were analyzed by HPLC-MS/MS. The semen qualities like semen volume, sperm concentration, motility and morphology and reproductive hormones, including follicle-stimulating hormone (FSH), luteinizing hormone (LH), testosterone (total T), free testosterone (fT), inhibin B and estradiol (E2) and sex hormone-binding globulin (SHBG) were measured. Results: After adjusted for creatinine, urinary MEP, MnBP, MEHHP, MECPP concentrations of infertile men with below or above WHO semen reference levels were significant higher than fertile men. After adjusted age, BMI, current smoking and drinking, total T was inversely associated with urinary MMP concentrations ($p<0.001$) and significantly negative associations between inhibin B and urinary DEHP metabolites as well as the ΣDEHP ($p<0.05$) were found. Urinary MiBP and MBzP concentrations were negatively associated with fT ($p<0.05$). Significant trend test between ΣDEHP and inhibin B, E2 were found ($p<0.05$). Conclusions:Our results suggest DEHP, DMP, DBP and BBzP exposures are robustly associated with minor alterations of some reproductive steroid hormones in men. Further research is needed to confirm these findings.

Abstract Number	**P-3-27-01**
Presenter	Ming-Tsang Wu*
Exposure	others
Health domains	other
Type of research	others

A Crossover Study of Noodle Soup Consumption in Melamine Bowls and Total Melamine Excretion in Urine

Background Melamine exposure remains common even after the 2008 melamine-tainted baby formula incident. Another source of melamine exposure is melamine tableware. Aims To investigate if consumption of hot noodle soup served in melamine bowls would increase total urinary melamine excretion. Methods In a randomized 2 x 2 crossover study, we asked one group (3 men and 3 women, Group A) to consume 500 mL hot noodle soup (initial temperature: 90oC) served in a melamine bowl as breakfast for 30 min. We collected spot urine sample prior to and in 2 hrs intervals for 12 hrs after consumption. Another group (3 men and 3 women, Group B), following the same procedures, consumed the same soup from ceramic bowls. After a 3-week washout, the assigned treatments were reversed. Urinary melamine levels were measured by LC-MS/MS. Total melamine excretion was calculated as melamine concentration of one-spot urine sample ´ amount of that spot urine and the amounts of all the urine samples collected for 12 hrs after the participant consumed hot noodle soup were summed. A Wilcoxon signed ranks test was calculated to examine the absolute differences of total melamine excretion between two groups. P-values were 2-sided; significance a 0.05 level. Results 12 healthy people (6 men, 6 women; aged 20-27 years) participated. All urine samples from all participants were collected after consumption for 12 hrs in both groups. Total melamine excretion (mean ± SE (standard error)) in urine for 12 hrs was 8.35 ± 1.91 mg and 1.31 ± 0.44 mg in melamine bowls and ceramic bowls, respectively. The difference was highly significant (7.04 ± 1.62 mg; $P = 0.0005$). Conclusions Melamine tableware may release large amounts of melamine when used to serve high temperature foods. Although the clinical significance of what levels of urinary melamine concentration has not yet been established, the consequences of long-term melamine exposure still should be of concern.

Abstract Number	**P-3-27-02**
Presenter	Pandora Kodrou*, José Rodriguez-Llanes, Debarati Guha-Sapir
Exposure	no exposure
Health domains	other
Type of research	others

A global analysis of earthquake mortality using a zero-inflated spatiotemporal model

Among the different public health consequences of acute events, such as earthquakes, mortality is one of the greatest contributors to the impact of affected population. In the past 20 years, earthquakes have killed 767,170 and injured 1,500,450 people around the globe. However, the distribution of deaths caused by earthquakes shows substantial variability in the geophysical characteristics of the event and in the demographics and environmental characteristics of the affected population. The analysis of earthquake events is complicated mainly by the non-Gaussian nature of count data and rare events and by the presence of spatial and temporal correlation. Although some studies have accounted for some of the complicating factors all of these factors have not been formally included in a statistical model. Typical statistical methodologies (i.e. GLM) had to be extended to accommodate the complexity of random effects such as those induced by spatio-temporal random fields. Although, the generalized linear mixed models (McCullogh & Searle, 2001) technique was able to handle random effects as well as fixed effects, there was the need to consider hierarchical Bayesian implementations (Diggle et al., 1998; Royle et al., 2002; Best et al., 2002; Christensen & Waagepetersen, 2002; Crainiceanu et al., 2003; Wikle, 2002). Bayesian hierarchical models can decompose the observed data into a series of conditional models; all linked together through basic probability relationships. A new database was created, on the basis of EM-DAT (WHO Collaborating Centre for Research on Epidemiology of Disasters. Université Catholique de Louvain – Brussels – Belgium. EM-DAT: the OFDA/CRED International Disasters Data Base, 2004), PAGER-CAT and EXPO-CAT (Allen et al. 2009). Earthquake events were compiled from 1960 to 2007. We will present all the data exploration steps and the modelling techniques on how the final model was constructed so that the aforementioned characteristics along with space-time random effects are accommodated in the model structure.

Abstract Number	**P-3-27-03**
Presenter	Elizabeth O'Connell, Christie Barker-Cummings, Thomasina Austin, Diana Smith, Sandra Halverson*
Exposure	no exposure
Health domains	no health domain
Type of research	others

A Multi-Functional Scheduling Tool for Epidemiologic Field Studies

“A Multi-Functional Scheduling Tool for Epidemiologic Field Studies” Large epidemiologic field studies require tools and procedures for scheduling study visits with participants. Study staff must be able to schedule and track participant appointments in the most efficient way while maintaining flexibility to accommodate inevitable schedule changes. Determining participant availability while simultaneously tracking field staff availability and calculating travel distance to appointment locations is very labor intensive. To address the need for a systematic and centralized approach to managing 3200 study visits occurring in participant homes in two states over a four year period, Social & Scientific Systems, Inc. (SSS) developed a multi-functional scheduling application. The Home Visit Scheduler is an ASP.net 3.5 web application with a SQL Server 2005 back end database. It utilizes Telerik and Ajax controls combined with C# and JavaScript code behind. The scheduler is maintained with Visual Studio and Red Gate database tools. It is installed on a Windows 2003 platform and uses Windows authentication. The scheduler interfaces with MapQuest and Google Maps API to calculate the distance between participant and field technician addresses. The application uses the smallest distance to recommend which field technician to schedule with each participant. The scheduler also provides reporting to help the study operations staff schedule field technicians’ travel, minimize costs, and provide a visual display of each field technician’s itinerary. The implementation of the scheduler has resulted in the ability to schedule participant appointments in real-time with seamless integration to other operational systems used for eligibility screening and enrollment and overall tracking of participant status and activities. Use of this tool has resulted in a more efficient way of managing all staff schedules and participant appointments, minimizing labor and travel costs as well as burnout associated with long driving distances for field staff.

Abstract Number	**P-3-27-04**
Presenter	Kenichi Azuma*, Iwao Uchiyama, Takahiko Katoh, Hiromitsu Ogata, Keiichi Arashidani, Naoki Kunugita
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	cross-sectional study

A nationwide survey to elucidate the population susceptible to chemicals in Japan: trends in population characteristics in recent decades

Susceptibility to chemical exposure may be related to the induction of medically unexplained syndromes such as sick building syndrome (SBS), multiple chemical sensitivity (MCS), and idiopathic environmental intolerance. SBS in housing is called Sick House Syndrome (SHS) in Japan. These syndromes have been issues of concern in the field of public health during the past two decades. The government ministries have taken effective measures such as guidelines for indoor air quality. We conducted a nationwide questionnaire survey to examine trends in the characteristics of the susceptible population to chemicals in the recent decade. A web based-survey was conducted in January 2012. Questionnaires to obtain information on symptoms, psychosomatic states, and the Quick Environment Exposure Sensitivity Inventory (QEESI) were administered to a general adult population randomly selected from approximately one million monitors registered in a leading online research company on the basis of Japanese demographic data. A total of 7245 individuals responded. The proportion of respondents diagnosed with MCS and SHS was 1.02% and 0.97%. The combined cut-off scores of three scales provided by Miller indicated that the prevalence of high susceptibility to chemical exposure was 4.4% among the general population, while the scores of two scales indicated that the prevalence of moderate susceptibility to chemical exposure was 7.7%. Our previous study conducted in July 2000 by means of an interview indicated that the corresponding percentages were 0.81%, 0.53%, 0.74%, and 2.1%, respectively. Lack of vigor, irritability, fatigue, anxiety, depressed mood, and somatic symptoms significantly increased with an increase in scores of the three scales ($p < 0.001$). QEESI scores were influenced by the psychosomatic state. Our study suggests that the prevalence of MCS and SHS as well as high susceptibility to chemical exposure still exist among the general population after a gap of 11 years.

Abstract Number	**P-3-27-05**
Presenter	Yuji Nishiwaki*, Norihito Eto
Exposure	light
Health domains	other
Type of research	exposure measurement

A preliminary investigation using a monitor for quantifying personal eye exposure to visible and ultraviolet radiation

Background Eye diseases including cataract, keratitis and pterygium have been reported to be sun exposure-related. The association between macular degeneration and blue light has also been discussed. Moreover, it is hypothesized that retinal exposure to blue light may influence the human circadian rhythm. However, no monitoring devices exist that can measure eyes exposure to visible and ultraviolet (UV) radiation over time. Therefore, we developed a novel mobile sensing system （Ray Sensing Glass System, RaySeG System） that can continuously measure and record the composition and intensity of light. The RaySeG System consists of three sensors embedded in eyeglass. The three sensors are for UV (260-400nm), visible lights (red 615, green 540 and blue 465 nm, peak wavelength each) and illumination intensity, respectively. Aims Here we report the results of the preliminary investigation using the RaySeG System. Methods After accuracy validation, volunteers wearing the RaySeg System were instructed to walk under various light conditions such as indoor and outdoor. Individual differences in eyes exposure to visible and UV radiation by different environment and behavior were examined. Results We confirmed high time resolution, high spectrum resolution in a wide dynamic range of the RaySeG System. In this preliminary investigation, we found a 3.8-fold individual difference in eyes exposure to visible and UV radiation. If limited to shorter wavelength (Blue light + UV), individual difference was more than 5-fold. Conclusions The RaySeG System is useful for quantitative assessment of personal eye exposure to UV and visible light. Our final goal is to apply this system in field epidemiological studies, which outcomes are eye diseases and circadian rhythm abnormality. Further experiments with larger numbers of subjects are required.

Abstract Number	**P-3-27-06**
Presenter	Kakha Nadirdze*, Nana PHIROSMANASHVILI
Exposure	arsenic
Health domains	healthrelated quality of life
Type of research	health impact assessment

A significant number of health problems can be attributed to environmental factors, which range from environmental, chemical, food, to housing quality and noise

A significant number of health problems can be attributed to environmental factors, which range from environmental, chemical, food, to housing quality and noise in Georgia. To provide high quality research is needed to underpin policies designed to influence the environmental factors that affect our Citizens Children's health. This issue reports on some of the latest research which points the way to robust health and environment policies and helps evaluate their impact. In Southern Caucasus the negative impact impacts of climate change are far-reaching, and scientific information about its possible health effects is emerging. Research into the effects of air pollution on health remains very critical in Tbilisi Capital of Georgia. Often overlooked are the health impacts of indoor air pollution; these are investigated in Levels of several air pollutants are higher indoors than outdoors, New compilation of research on indoor industrial air pollutants and Air pollution policy must be based on indoor and outdoor sources. Resistance to antimicrobials, such as antibiotics and disinfectants, is a major cause for concern – both for our health and the environment. To assess and manage environmental health risks, such as those explored in this issue, human biomonitoring can be hugely valuable. We recognize the complexity of environment and health issues. Chemicals were seen as predominantly being 'dangerous' and leading to more harm than good. Rural People in Racha region lot of Arsenic on open Air and they are observing the worsen environment around them and bad health not relying on government alerts. Overall 78% in these regions are indicated that they are not happy to wait "Until the government alerts them about a specific environmental health problem replacing Arsenic as most dangerous and highest alert on their health.

Abstract Number	**P-3-27-07**
Presenter	Christie Barker-Cummings, Elizabeth O'Connell, Jane Hoppin, Stephanie J. London, John Hankinson, Sandra Halverson*
Exposure	no exposure
Health domains	respiratory disease
Type of research	others

Achieving and Maintaining High Quality Spirometry Results in an Epidemiologic Field Study

Obtaining high-quality spirometry data for research conducted in subjects' homes is challenging. However consistent high quality can be maintained by careful training and certification, thorough and timely review of results, and detailed feedback to field staff. In a study of respiratory outcomes in farmers and their spouses in Iowa and North Carolina, we have conducted pre and post bronchodilator spirometry in the homes of ~2700 participants over 4 years. Fifteen field technicians with no prior formal training in spirometry have been trained using the EasyOne Spirometer with screen visualization since 2009. Initial spirometry training and certification included online and in-person courses taught by a NIOSH-certified instructor followed by both online and written exams and practice with study equipment. Prior to testing study participants on their own, newly trained technicians demonstrate successful practice tests with volunteers and observe multiple home visits conducted by existing staff. Once certified to conduct spirometry in subjects' homes, the technician's results are transmitted weekly to an expert reviewer for quality control review and interpretation. Within a few days, the reviewer provides a file with flow-volume and volume-time curves and performance feedback comments for every test conducted. Study managers review the feedback files and follow-up with staff to provide additional instruction and coaching. Quarterly summary reports of quality metrics by technician are also reviewed. Implementation of the above protocol has resulted in very good spirometry data comparable to studies done in fixed research centers (2656 (96.5%) of 2753 pre-bronchodilator tests are useable). Quality is very comparable across technicians and consistent within technician over time. We credit this successful collection of high quality PFT data in homes to a combined approach of rigorous initial training and certification and timely consistent performance feedback to staff.

Abstract Number	**P-3-27-08**
Presenter	Judith Lamb, Karen Galea*, Martie van Tongeren, Brian Miller, Gary Hazelwood, Shahzad Rashid
Exposure	others
Health domains	no health domain
Type of research	exposure modeling

An Evaluation of the Between-User Reliability of Tier 1 Tools Used for Exposure Assessment under REACH

As part of a tiered approach to human and environmental chemical risk characterisation under REACH, several Tier 1 screening tools are recommended by ECHA for estimating occupational exposure, including the ECETOC TRA, EMKG-EXPO-TOOL, MEASE, STOFFENMANAGER and RISKOFDERM. The ETEAM Project (Evaluation of Tier 1 Exposure Assessment Models under REACH) aims to comprehensively evaluate the conceptual bases, uncertainty, user-friendliness and reliability of these tools. When applying the tools to a workplace situation, users must select options from several possible input parameters. Application of the tools thus relies on professional experience and judgment, combined with access to an appropriate level of information. Within the scope of the overall ETEAM Project, this study presents an assessment of consistency between tool users in making these input choices, i.e. the between-user reliability of the tools. Two methods were used to identify and characterise the tool parameters associated with between-user variability: a 'remote-completion' exercise and a focus group. In the remote-completion exercise, participants generated dermal and inhalation exposure estimates from a defined set of exposure situation descriptions (n=20)/Tier 1 tool (n=6) combinations over a fixed time period. A randomised distribution of the exposure situation/tool combinations was designed to ensure sufficient overlap between combinations to allow analysis of variability of output between users. Exposure estimates (n=2033) were obtained from 150 participants. Quantitative analysis of the level of agreement between different tool users was performed and the interactions between users, tools and situations described. Qualitative analysis was carried out of detailed feedback from a focus group of exercise participants. The study findings presented at the conference will be of significant use to developers and users of Tier 1 tools used in occupational, consumer and environmental exposure assessment under REACH.

Abstract Number	**P-3-27-09**
Presenter	Antonis Georgellis*, Anne-Sophie Merritt, Niklas Andersson, Tom Bellander
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Children´s environmental health questionnaire survey 2011

Background and aim: In Sweden, national Environmental Health surveys (E&H) have been conducted every 4th year since 1999. The E&H 2011 aimed at describing environment and related health in Swedish children. Methods: The survey was by invitation to answer web questionnaires to more than 84,000 children aged 6-10 months, 4, 8, 12 and 16 years, followed by paper questionnaires to non-responders. It included questions on the child's health status (allergy, asthma and other airway symptoms as well as hearing difficulties and annoyances), life style factors, family and housing conditions. The exposure questions aimed at describing the child's exposure to parental smoking, noise, air pollutants, mould and toxic substances. The response rate was 50 % and all prevalence estimates were weighted using demographic variables to correspond to the target population. Changes over time were analysed by comparison with the E&H 2003. Results: . In 2011, 11% of Swedish children lived in homes with a window facing a street with intensive traffic.In addition, 40% of 16- and 20% of 12-year-olds children spend more than one hour each day in traffic environments, going to and from school or other activities. These estimates, and many other, had not changed markedly since 2003. In contrast, in children at 12 years of age, the prevalence of asthma had increased from 6% to 9%, and complaints from noise in the school environment increased from 18% to 31%. Finally, a dramatic decline of exposure to environmental tobacco smoke was observed, from 21% in 2003 to 11% in 2011. Conclusions: Many children live in areas with heavy traffic. The prevalence of asthma and complaints on noise in school had increased in an 8-year period, while exposure to tobacco smoke had decreased. The web and paper-based survey may be used for monitoring the population's experience of environment and health, giving a basis for decision making on measures to reduce the health risks from different environmental factors.

Abstract Number	**P-3-27-10**
Presenter	Nafiseh Hamidi*
Exposure	others
Health domains	other
Type of research	review

Deeper assessment of "indoor environmental quality" by employing mixed method approach (A case study of Personal ventilation system)

This paper is an exclusive literature review on the effectiveness of creating non-uniform environment in regard to enhance the human thermal comfort. Many studies exist that demonstrate the poorness of office buildings' design in regard to providing the sutable thermal comfort, all around the world (Federspiel 2001and Huizenga et al, 2006, Karjalainen 2007, Kuchen and Fisch 2008).Thermal comfort has a significant effect on occupants' productivity (Tham 2004) and health (Wargocki et al, 2002a). Consequently poor thermal comfort results in dramatic economic loss for businesses and governments (FAST, 2002). The majority of thermal comfort researchers are focused on how to enhance it in uniform environment. However there are studies that prove that non-uniform environments can provide better thermal comfort, while requiring less energy consumption (Zhang et al 2008) and Arens et al 2008). Non-uniform environments can be categorised into two categories; vertical and horizontal. Vertical non-uniform environments can enhance the thermal comfort by modify the stratification (vertical temperature differences) or alternatively widen the range of acceptable stratification (Zhang et al. 2005 and Webster and Bauman, 2002a). It also aims to eliminate the local thermal discomfort by focusing on differences in different body parts thermal sensation in different thermal conditions (cold or warm) (Arens 2005a and Zhang 2003). Unlike a uniform environment, horizontal non-uniform environments or thermal variation (horizontal temperature differences) can result in achieving the thermal feeling higher than thermal neutral termed thermal pleasantness (Arens 2008). Thermal variation would be possible when the facility to move between two thermally different spaces is available for occupants. Thermal variation can contribute to the thermal comfort context by creating thermal pleasure (Kuno 1995), environmental stimulation(Kwok, 2000) or eliminating thermal boredom (Drake et al. 2009).

Abstract Number	**P-3-27-11**
Presenter	Karen Galea*, Carolyn McGonagle, David Todd, Anne Sleeuwenhoek, Alison Searl
Exposure	others
Health domains	skin disease
Type of research	exposure measurement

Development and comparison of two sampling methods to assess dermal exposure to drilling fluids and crude oil

Dermal exposure to drilling fluids and crude oil is an exposure route of concern although there have been no published studies describing sampling methods or reporting dermal exposure measurements. We describe a study that aimed to evaluate further a developed wipe sampling method for assessing dermal exposure to drilling fluid and crude oil, as well as to investigate the feasibility of using an interception cotton glove sampler for the hands/wrists. A direct comparison of the wipe and interception method was also completed using surrogate human skin and a direct surface contact exposure situation. The wipe and interception sampling methods were evaluated using an oil-based drilling fluid and crude oil. Overall, acceptable recovery and sampling efficiencies were reported for both methods and both were found to show satisfactory storage stability for 1 and 7 days, although there appeared to be some loss over 14 days. The results from the side-by-side direct surface contact experiments revealed that much higher recoveries of both fluids were measured on the glove samples than on wipe samples (on average 2.5 times higher). Both evaluated sampling methods were found to be suitable for use in assessing dermal exposure to oil based drilling fluids however the comparison study clearly illustrated that the interception technique over-estimated dermal exposure. Further comparison of the two dermal sampling methods using additional exposure situations such as immersion or deposition, as well as a field evaluation, is warranted to confirm their appropriateness and suitability to assess dermal exposure to drilling fluids and crude oil in the working environment. This information, with due consideration of the sampling strategies aims and objectives, will help facilitate dermal sampler selection.

Abstract Number	**P-3-27-12**
Presenter	EUN-HYE Kim*, Byoung-Hak Jeon, Hae-Kwan Cheong, Jihyun Kim, Youngshin Han, Kang Mo Ahn
Exposure	biomarker
Health domains	skin disease
Type of research	time series study

Effect of urinary concentration of phthalates and bisphenol A metabolites n the atopic dermatitis symptoms of children in a child day care center

Background The aim of this study was to evaluate the association of urinary phthalate and bisphenol A concentration on the severity of atopic dermatitis symptoms in children. Methods From May 2009 through April 2010, we surveyed 38 children, between the ages of three and seven years, in a child day care center in Seoul metropolitan city. Each teacher recorded an atopic dermatitis diary, which is consisted of scores on daily pruritus index, daily activity schedule, and ten questions on indoor environment. Biological monitoring of urine from boys' stool collected twice a day, at 11:30 am and 4:00 pm, was conducted to assess the phthalate and bispheol A level of the children. We measured the urinary concentraions of mono-2-ethyl-5-oxohexyl phthalate (5-oxo-MEHP), mono-2-ethyl-5-hydroxyhexyl phthalate(5-OH-MEHP), mono-isobutyl phthalate (MnBP), Bispenol A. Presence of the atopic dermatitis symptom was analyzed using logistic regression analysis after controlling for the potential confounders. Results Most of the phthalate metabolite levels were higher in the morning urine in the afternoon. There was a seasonal variation and highest level of 5-OH-MEHP, MnBP, and bisphenol A was measured during summer. Manifestation of atopic dermatitis symptoms was associated with 1 μg/L increase of urinary level of MnBP (adjusted odds ratio =4.37, 95% CI: 1.35~14.17) and bisphenol A (aOR 2.09, 95% CI: 1.11~3.94). Conclusion It is suggested that phthalate and bisphenol A may be associated with aggravation of atopic dermatitis symptom.

Abstract Number	**P-3-27-13**
Presenter	Ilce Silva*, Rosalina Kpoifman, Vanessa Dantas, Sergio Koifman
Exposure	others
Health domains	cancer
Type of research	cohort study

Environmental factors and HPV status predicts treatment failure of cervical precancerous lesions among Brazilian women

Background:Cervical cancer is preventable through the detection and treatment of precancerous lesions, known as cervical intraepithelial neoplasia (CIN). However, treatment failure occurs around 5-35%, and there is no consensus about the risk factors involved. Aim: To evaluate the effect of HPV and selected environmental factors on the risk of CIN treatment failure among Brazilian women. Methods: A prospective study was carried out among 208 outpatients treated for CIN at the Brazilian National Cancer Institute, Rio de Janeiro, between 2004 and 2008. All patients were interviewed to identify epidemiological and clinical characteristics. Three months after treatment (1st follow up) cervical smears were taken for HPV test. The study population was followed up with Pap-tests during two years. Kaplan-Meyer curves and Cox Proportional Risk Model were used for data analysis. Results: Mean age was 35 (+11) years old, mean age at sexual onset was 17 (+3) years old, 69.1% were non-white, 28.1% were current smokers, 21.4% former smokers, 15.4% were current oral contraceptive (OC) users, 23.2% were former users, 38.5% were HPV+, and 35.7% had margin involvement. After 2 years, the likely of treatment failure was statistically higher among HPV+ comparing to HPV- women, among never OC users (were 45.5% vs 17,6%), former users were (65.1% vs 18%), and current users (75.8% vs 51.3%), suggesting a possible interaction between both exposures. The independent hazard ratio for treatment failure associate with HPV was 2.0 (95%CI 1.1-3.6), with current contraceptive use was 2.16 (95%CI 1.1 – 4.4), and with margin involvement was 1.8 (95%CI 1.0-3.2). The HPV hazards were statistically associated even among never OC users (HR=2,25; 95%CI 1.1-4.7) and former users (HR=3,52; 95%CI 1,06-11,67).Conclusion: women who are HPV+ after CIN treatment and current contraceptive users are at higher risk of treatment failure in 2 years, even controlling the effect of age and margin involvement.

Abstract Number	**P-3-27-14**
Presenter	Nandini Choudhury*, Veena Iyer, Gulrez Shah Azhar, Vidwan Dhruwey, Russell Dacombe, Ashish Upadhyay
Exposure	no exposure
Health domains	infectious diseases
Type of research	review

How infected is Gujarat: Comparison of selected infectious disease rates with India

Background: The infectious disease profile of India is changing due to increased human environmental interactions, urbanisation and climate change. There are also predictions of explosive growth in infectious and zoonotic diseases. The Integrated Disease Surveillance Project (IDSP) was implemented in Gujarat in 2004. Aims: We aimed to analyse IDSP data on seven laboratory confirmed infectious diseases in the state of Gujarat, India. Methods: The IDSP data was analysed and compared this to the National Health Profile data during the same period and other literature on temporal and spatial trends from 2005 to 2011. We chose seven laboratory confirmed infectious diseases, Enteric fever, Cholera, Hepatitis, Dengue, Chikungunya, Measles and Diphtheria in the state as well designed vertical programs already exist for other diseases. Statistical and GIS analysis was done using appropriate software. Ethical clearence was obtained from the IRB. Results: Our analysis shows that the existing surveillance system in the state is predominantly reporting urban cases. There are wide variations among reported cases within the state with reports of Enteric fever and Measles being less than half of the national average, while Cholera, Viral Hepatitis and Dengue being nearly double. We found some limitations in the IDSP system with regard to the number of reporting units and cases in the background of a mixed health system with multiplicity of treatment providers and payment mechanisms. Conclusions: Despite these limitations IDSP can be strengthened into a comprehensive surveillance system capable of tackling the challenge of reversing the endemicity of these diseases and preventing the emergence of others.

Abstract Number	**P-3-27-15**
Presenter	Toan Vu Van*, Phuc Pham Duc, Hung Nguyen Viet, Bich Tran Huu, Christian Zurbrugg, Jakob Zinsstag
Exposure	no exposure
Health domains	parasitic disease
Type of research	others

Hygienic quality of human excreta in the storage options in Vietnam

Hygienic quality of human excreta in the storage options in Vietnam Background The use of human excreta in agriculture presents potential health risks if excreta are not properly treated before using as fertilizer. In Vietnam, farmers traditionally store and compost excreta before fertilizing crops. However, the level of safety of the current storage and composting options for health and environment are not scientifically examined. Optimizing excreta storage options to ensure the safety of their use is of great importance for public health and the environment. Aims This study aimed to investigate whether hygienically safe fertilizer could be produced in the different storage options of human excreta. Methods We set up a human excreta storage experiment with 24 storage vaults with different additive matters (lime, rice husk, ashes). Half of vaults had an air ventilation system consisting of a plastic pipe with a series of small holes. The storage options were conducted under conditions similar to those currently used in Vietnamese latrines. Stored excreta were collected every 2 weeks over 6.5 months, giving 336 samples. The number and viability of Ascaris lumbricoides eggs were measured by Romanenko method. pH, moisture content, and temperature of samples were recorded during the storage time. Results The results showed that 92% of A. lumbricoides eggs die-off after 6.5 months of storage for all storage options with the starting pH varied from 7.9 to 10.6 and the temperature varied from 17.4 to 32.6°C. The multivariable linear regression model showed that the parameter found to best determine the A. lumbricoides eggs die-off was the storage period, as it explained 76% of the variation of dead A. lumbricoides eggs. Conclusions The study indicated that a longer storage period is needed for parasite eggs die-off, and the current Vietnamese farmer practice storage of human excreta might be ineffective to kill all of parasitic pathogens over 6 months storage period.

Abstract Number	**P-3-27-16**
Presenter	Hulya Gul*, Bilge Hapcoglu, Zahide Ceren Atli
Exposure	others
Health domains	cancer
Type of research	case-control study

Identification of environmental risk factors which women with breast cancer have been exposed to in Istanbul

Background:Breast cancer is the most common malign tumor in women worldwide. Breast cancer is a significant public health problem both because of its frequency and its fatality. The best way to fight with cancer is prevention by controlling the risk factors. There are known or suspected many risk factors which cause breast cancer. Aim: In this study, it was aimed to define the potential environmental risk factors which are involved in the pathogenesis of breast cancer in women. Method: This case-control study was conducted between November 01st, 2012 and January 31th, 2013. The study population was consisted of women of 30 years of age and above who presented to the university hospitals in Istanbul. A total of 200 women, who accepted to participate in the study, were included. 100 of these women had a diagnosis of breast cancer and 100 were included as the control group. A questionnaire was applied in the study by an interview. The questionnaire form was consisted of questions related to history of parity, familial history, alcohol consumption, nutritional habits, body weight, socioeconomic status, life style, environmental factors etc. Conclusion:A decrease in the risk of breast cancer can be achieved by some changes in life style. Women should be informed and their awareness should be raised about the environmental risk factors which are involved in breast cancer to decrease the mortality due to this cancer.

Abstract Number	**P-3-27-17**
Presenter	Colin Butler*
Exposure	others
Health domains	other
Type of research	review

Is climate change as large a health threat as some have proposed? A new conceptual framework suggests it is.

Background: Climate change has been called the greatest threat to global health. But, most literature concerning climate change and health has focused on manifestations with a comparatively low burden of disease. Even the death toll (up to 130,000) from two extraordinary heatwaves (Russia 2010, Europe, 2003) is low compared to (for example) that from neglected diseases of poverty. While malaria has a large current burden of disease, the attributable fraction due to climate change is minor, though this may increase. Climate change is increasingly recognised as contributing to numerous other infectious diseases, but the burden of disease of these due to climate change, even cumulative, is also minor. If climate change is a significant global health threat, then the causal pathways involved seem unlikely to arise directly from either heatwaves or infectious diseases. Aims: This paper seeks to explain why there is such anxiety (by some) about this topic, and to investigate if this concern is warranted. Method: A focused literature review, conducted from 1989 to the present, was used to develop a conceptual framework to explore these issues. Results: There is a growing multidisciplinary literature which suggests that systemic, interacting (or "tertiary") health effects of climate change may be the most important risk to global health this century. These effects include large scale under-nutrition as food prices rise due to climate change; famine, migration, conflict and lost economic productivity from multiple causes. But, climate change does not act alone to create these risks, instead it operates synergistically with social and other environmental factors. Causality depends on the "focal depth" of the investigator. A book on these issues, with over 50 contributors, is almost complete. Conclusion: Climate change is an enormous risk to global human health, but its most important manifestations and pathways are as yet poorly appreciated, including within the health

Abstract Number	**P-3-27-18**
Presenter	Min-ha Han*, Yun Chul Hong, HyeSook Park, Mina Ha, Yangho Kim, Eun-Hee Ha
Exposure	metals
Health domains	neurodevelopment
Type of research	others

Methods for combining cohort data set having different variables for pooled-analysis

BACKGROUND : When we conduct pooled-analysis from different cohort data, we often face data set having different variables. In addition, the system of collecting cohort data may different among studies. Therefore, we need to find how to reduce bias taking advantage of statistical and mathematical methods. Further, we will discuss the way to set the thresholds of effects in cohort study. METHODS : We used cohort data of infants from BICCA(Birth cohort consortium of Asia) which develops a core set of exposure and outcome measures. Since the cohort data have various variables, we used multivariate analysis. We also used randomized sampling methods and Monte-Carlo Variance Reduction Principle for proof. RESULTS : When extracting from original data set using SRSWR(Simple Random Sampling With Reputation) with stratified method, we found Monte-Carlo Principal was applicable. The 1st stratum was center and 2nd stratum was inspector. We found that variance was reduced, which means bias was reduced. Also, when we compared 3 countries with final regression model, converting each variable for normalization fit better than just setting original variable. For instance, to compare Infant's neurodevelopment, there is different estimator among 3 countries. When we normalized similar category of Taipei's and Japan's to Korea's Bayley, we got better fitting.(Variance reduced almost to 1/4) CONCLUSION : We obtained more reliable result using new variables when combining data of different cohort studies. Also, by normalization, we can combine, similar but not exactly same estimator. In this manner, countries which couldn't do this cohort study because of the expansive cost of neurodevelopment, can now do it, giving possibility that international cohort study will be opened. For this reason, I also submit it to the Symposium. Keywords : Monte-carlo method, pooled-analysis, substitution to bayley

Abstract Number	**P-3-27-19**
Presenter	Hyun Sook Bae*, Su Ryeon Noh, Yong Jin Jeon, Jung Ah Kim, Gwi Heum Eom, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong, Eun-Hee Ha
Exposure	biomarker
Health domains	neurodevelopment
Type of research	cohort study

Mothers and Children's Environmental Health Study in Hebei Spirit Oil Spill

Background: An oil spill of 12,547 kl occurred due to the collision of a crane and the oil tanker Hebei Spirit, at the coast of Taean-gun, Korea on December 7, 2007. Mothers and children may be more sensitive to environmental pollution. Aims: We have established a cohort study of pregnant women and their children to enable evaluation that gestational exposure to spilled crude oil components from mother affects their children's growth, development, and disease. Methods: Eighty pregnant women were recruited between February to March, 2008 to perform follow-up studies on their children. We collected demographic, socio-economic characteristics, nutritional assessment, oil spill exposure information, and biological samples including blood, placenta, urine, and breast milk. Results: Pregnant women, their partners, and their children were investigated during the first and third trimesters for prenatal examinations, the birth, the 6, 12, 24, 36, and 48 months for postnatal examinations were investigated, and follow-up studies are currently underway. Questionnaires included the socio-demographic information, medical and obstetric history, family history, complications related to the current pregnancy, nutrition, oil exposure, and medical utilization of their neonates and infants. Nutritional status was assessed by the 24-hour recall and the food frequency questionnaire (FFQ). Maternal venous blood at 20 weeks of gestation of less, cord blood and placental tissue at birth, and urine sample from mother at less than 20 weeks of gestation and from their child at 6, 12, 24, 36 months of age were collected. Conclusions: A continued surveillance of children who were exposed to crude oil components in gestational age is necessary. We expect that the results from this cohort will enable the establishment of a national policy.

Abstract Number	**P-3-27-20**
Presenter	Hyun Sook Bae*, Su Ryeon Noh, Yong Jin Jeon, Gwi Heum Eom, Jung Ah Kim, Young-Hyun Choi, Mina Ha, Hae-Kwan Cheong, Eun-Hee Ha
Exposure	biomarker
Health domains	neurodevelopment
Type of research	cohort study

Mothers and Their Infants' Health From Gestational Exposure to the Hebei Spirit Oil Spill

Background: A crude oil of 12,547 kl was spilled by the oil tanker Hebei Spirit in December, 2007. A prospective birth cohort study was built from recruiting pregnant women living in the most severely hit county in March, 2008. Aims: To monitor the adverse health effects in mothers and their children from the Hebei Spirit oil spill exposure during gestational period. Methods: We compared 80 exposed-mothers and their 80 children with matched 439 unexposed-mothers and their 439 children who were demographically similar selected from the longitudinal birth cohort study of Korea, named MOCEH.The concentration of oil constituents in body and ultrasonography of pregnant women were measured in their first and third trimesters. The incidence of allergies and neurocognitive development using the Korean Ages and Stages Questionnaires (K-ASQ) of their infants were performed in 6 months after birth. Results: The blood lead and cadmium concentration of exposed group's women and their spouses were significantly higher than the non-exposed group in the early stage of pregnancy. The urinary levels of hippuric acid in the first trimaster had an effect on fetal growth and development including femur length and biparietal diameter. Allergic reactions of 6-month-old infants in the exposed group (26.3%) were significantly higher than the non-exposed group (7.6%). The K-ASQ total score in the exposed group (233.5 points) was significantly lower than non-exposed group (247.9 points). Conclusions: Exposure to the Hebei Spirit oil spill constituents for women in their early pregnancy stage might affect their and their infants' health. There is a need to look through continuous observation.

Abstract Number	**P-3-27-21**
Presenter	Erik Petersen*, Stefan Gartiser, Susanne Smolka, Barbara Jahn, Stefanie Wieck
Exposure	pesticides
Health domains	other
Type of research	review

Nanosilver in Medical and Consumer Products: Risks for Health and Environment?

Background Nanosilver is the most used nanoscaled material in consumer products in Germany, whereas most consumers are not aware of which products contain nanosilver. The biocidal effect is used not only for preservation of materials but more often against the real or supposed risk of infection or only against unpleasant odours caused by bacteria. Today there is no obligation for marking the products and the term „nano" isn't protected by law. Within the new Biocidal Product Regulation (BPR) this gap will be filled regarding nano-biocides from 1.9.2013 on. Aims The potentail risks for the environment and health is not clear yet. The effect of nanosilver is mainly biocidal. Nanoparticles are washed out the treated products into the waste water and into the environment. There are strong scientific efforts in estimating the risks for the different compartments of the environment. Methods This overview concerns new products with nanotechnological protection and highlights the discussion in Germany regarding the environmental and health implications caused by the use of nanosilver in particular. Last but not least some demands from the non-governmental point of view are presented. Results The scientific community is mainly convinced that the use of nanosilver in consumer products is needless and probably more harmful than useful. Nanosilver is accused to contribute to a high degree to the increasing antibiotic resistance of pathogens and is toxic to human cells. Most of the Non-Governmental Organisations support strongly the restriction of any use for medical indications only. They are in favour of an inventory and an effective marking of all kinds of products with nanoscaled material. This is in process because under the new BPR a labelling of nanomaterial is obilgated. An inventory of all kinds of nanoscaled materials is under discussion on the European level. Conclusions The new BPR is one step in the right direction to assess the risks of nanosilver in products.

Abstract Number	**P-3-27-23**
Presenter	Niklas Andersson*, Tomas Lind, Tom Bellander
Exposure	others
Health domains	other
Type of research	cross-sectional study

Non-response and time-to-response in the Swedish Environment & Health surveys

Background Non-response in surveys is a threat to validity. Over the past decades the response rate in the Swedish Environment & Health (E&H) surveys has decreased from over 80% to about 50%. Aims Does non-response bias the results in the E&H surveys? Can such bias be controlled by population weights? Are early responders different from late responders? Methods The E&H 2011, including 328 items on physical environment and health, were sent to parents of children aged up to 12 and to adolescents in Sweden, using a stratified sample of 84,000. The response rate was 50%. A telephone-based non-response survey (NRS), to a random sample of 1667 non-responders, covered 18 of the E&H 2011 items. The NRS response rate was 46%. Population weights were derived using age, gender and other demographic variables for the samples and the target population. Prevalence estimates change with time-to-response was analyzed using mean values. Results For 13 out of 18 items the prevalence estimated using weights was higher than the raw prevalence in the E&H 2011 data. The difference between the former estimates and NRS (both weighted) was less than 2 %-units for 15 out of 18 items. Four items showed a statistically significant difference with a larger point estimate in E&H 2011. The difference was up to 14 %- units. The result based on cumulative prevalence showed that for 8 out of 18 items the prevalence using the first half of all returned questionnaires (corresponding to ¼ of all questionnaires sent out), the estimated prevalence was within 5 per cent of the final estimate using all returned questionnaires. Conclusions Population-weighted estimates of prevalence did not differ from those for non-responders, but were in general higher than unweighted E&H survey estimates. The trends in the prevalence estimates with time-to-response, suggested that early responders were different from late responders, but for about half of the questions no further improvement was noted after 25% response.

Abstract Number	**P-3-27-24**
Presenter	Zhang Honglong, Zhongjie Li, Shengjie Lai*, Archie Clements, Wenbiao Hu, Weizhong Yang
Exposure	others
Health domains	infectious diseases
Type of research	others

Performance evaluation of CIDARS on dengue fever outbreak detection, China

Performance evaluation of CIDARS on dengue fever outbreak detection, China Honglong Zhanga#, Zhongjie Lia#, Shengjie Laia, Archie Clementsb, Wenbiao Hub*, Weizhong Yanga* a Key Laboratory of Surveillance and Early-warning on infectious Disease, Division of Infectious Diseases, Chinese Center for Disease Control and Prevention, Beijing 102206 b School of Population Health, The University of Queensland, Brisbane 4006 QLD, Australia #: These authors contributed equally *Correspondence : Weizhong Yang: yangwz@chinacdc.cn Wenbiao Hu: w.hu@sph.uq.edu.au Background For more effective prevention and control of dengue fever (DF), a China Infectious Disease Automated-alert and Response System (CIDARS) was used to identify possible early warning signals of DF outbreaks at country level in China. Aims This study aims to evaluate the performance of the CIDARS early warning system for DF. Methods In CIDARS a time series moving percentile method was used to detect the outbreak of DF. If the cases of reported DF are over 50 percentile of historical data, an early warning signal will be generated and sent to the local county CDC staff who are responsible for certifying and investigating the signals. In this study, descriptive analysis was used to display the spatial and temporal patterns of DF reported cases and early warning signals of DF during the study period. Sensitivity, specificity and timeliness were employed to assess the performance of DF early warning in CIDARS. Results There were 651 reported DF cases in China between 1st January 2009 and 31st December 2011. 58 signals were mostly occurred between August and December and distributed in Guangdong (35), Zhejiang (7) and Guangxi (4) provinces. 93.10% signals were responded within 24 hours. There were 9 outbreaks of DF recorded during study period with 8 (88.9%) outbreaks detected by CIDARS. The average time of outbreaks detection by CIDARS was 0.63 day. Conclusions CIDARS is a useful platform to detect the DF outbreak at early stage. More accurate algorithms could be tested to reduce the negative signals.

Abstract Number	**P-3-27-25**
Presenter	Zhang Honglong*, Zhongjie Li, Shengjie Lai, Archie Clements, Wenbiao Hu, Weizhong Yang
Exposure	no exposure
Health domains	infectious diseases
Type of research	others

Performance evaluation of CIDARS on dengue fever outbreak detection, China

Performance evaluation of CIDARS on dengue fever outbreak detection, China HongLong Zhanga#, Zhongjie Lia#, Shengjie Laia, Archie Clementsb, Wenbiao Hub*, Weizhong Yanga* a Key Laboratory of Surveillance and Early-warning on infectious Disease, Division of Infectious Diseases, Chinese Center for Disease Control and Prevention, Beijing 102206 b School of Population Health, The University of Queensland, Brisbane 4006 QLD, Australia #: These authors contributed equally *Correspondence : Weizhong Yang: yangwz@chinacdc.cn Wenbiao Hu: w.hu@sph.uq.edu.au Background For more effective prevention and control of dengue fever (DF), a China Infectious Disease Automated-alert and Response System (CIDARS) was used to identify possible early warning signals of DF outbreaks at country level in China. Aims This study aims to evaluate the performance of the CIDARS early warning system for DF.Methods In CIDARS a time series moving percentile method was used to detect the outbreak of DF. If the cases of reported DF are over 50 percentile of historical data, an early warning signal will be generated and sent to the local county CDC staff who are responsible for certifying and investigating the signals. In this study, descriptive analysis was used to display the spatial and temporal patterns of DF reported cases and early warning signals of DF during the study period. Sensitivity, specificity and timeliness were employed to assess the performance of DF early warning in CIDARS.Results There were 651 reported DF cases in China between 1st January 2009 and 31st December 2011. 58 signals were mostly occurred between August and December and distributed in Guangdong (35), Zhejiang (7) and Guangxi (4) provinces. 93.10% signals were responded within 24 hours. There were 9 outbreaks of DF recorded during study period with 8 (88.9%) outbreaks detected by CIDARS. The average time of outbreaks detection by CIDARS was 0.63 day. Conclusions CIDARS is a useful platform to detect the DF outbreak at early stage. More accurate algorithms could be tested to reduce the negative signals.

Abstract Number	**P-3-27-26**
Presenter	Nicolle S. Tulve*, Marina Quadros, Kim Rogers, Robert Willis, Linsey Marr
Exposure	others
Health domains	no health domain
Type of research	exposure measurement

Potential Exposure to Silver Nanoparticles in Children's Consumer Products

Background: Due to its antimicrobial properties, nanosilver (nAg) is used in many consumer products intended for use by or near children. Objective: Our objective was to determine if nAg is released from children's consumer products under conditions of intended use and to assess the potential for exposure. Methods: From an inventory of 82 products claiming to contain nAg, 13 products (plush toy, three fabric products, breastmilk storage bags, two sippy cups, three cleaning products, two humidifiers, one humidifier accessory) were chosen for evaluation. Total extractable Ag was measured by ICPMS; leachable Ag was measured using liquids (synthetic urine, sweat, saliva; tap water; orange juice; milk formula) relevant to each product's intended use; and electron microscopy confirmed the presence of nAg. Results: All products contained silver except for one humidifier and the humidifier accessory; however, nAg was confirmed in only the plush toy, spray cleaner, and one fabric product. Synthetic sweat and urine leached the largest fraction of total Ag from the plush toy and fabric products, 6-38%, while tap water leached the lowest amount, 0.5-2.6%. Sippy cup components leached Ag in both milk formula and orange juice. No relationship was found between pH and the level of Ag leached. Most, if not all, of the Ag leached by the synthetic liquids was in ionic form, suggesting dissolution as the main leaching mechanism. There was no general trend between product aging and leaching. Between 0.3 and 23 µg m-2 of Ag was found to transfer from products (or wiped surfaces) to the wipes. Conclusions: Levels of Ag to which children may potentially be exposed are predicted to be low, and bioavailable Ag is expected to be in ionic form. These results advance our understanding of potential exposures to nAg from children's consumer products by providing tools to investigate nAg movement from consumer products.

Abstract Number	**P-3-27-27**
Presenter	Abril Asminda Rivera Valerio*, María Guadalupe Garibay-Chávez
Exposure	others
Health domains	other
Type of research	cross-sectional study

Risk of vehicle accidents among young drivers in the Metropolitan Area of Guadalajara:2000-2010

BACKGROUND: Motor-vehicle accidents are the first cause of accidental death in the Metropolitan Area of Guadalajara (MAG), Mexico. The 16-24 age group represents a total of 1,307.882 persons and 33% of those affected by this type of accident. Certain factors increase young people's exposure and vulnerability to suffering this type of accident. AIMS: Analyze the risk of suffering motor-vehicle accidents among 16-24 year-old people within the MAG during 2000-2010, considering the factors that increase such age group's exposure and vulnerability. METHODS: Information on motor-vehicle accidents was obtained from the Highway Traffic Accident Statistics in Urban and Suburban Areas. Thirty young drivers from this age group with a history of traffic accident involvement during 2000-2010 were interviewed. Six exposure factors and eight vulnerability factors involved in suchtype of accidents were analyzed. RESULTS: Accidents involving young people increased, the rate of being involved in accidents in 2010 per 1000 young people was 21.67 and the mortality rate was 4.30 per 1000. The most affected by accidents was 20-year olds 51%. The interview respondents attributed the most frequent cause of accidents to other drivers 47%, reckless or rash behavior 33%, distractions while driving 30% and consuming alcohol 27%. The young respondents identified the following factors as those that expose them to accidents, in order of importance: driving after drinking alcohol 70%, driving at night or at dawn 60%, and the time they spent in automobiles (47% drove seven days a week). The factors that increased vulnerability to accidents were: driving in an altered sate, while mad or sad 83%. CONCLUSIONS: Individuals who are 20 years of age are the most affected age group with respect to accidents. The factors that increase exposure are driving under the influence of alcohol, driving at night or dawn and the time spent in automobiles. The factors that increase vulnerability are driving in altered states, sleepiness, driving without a license.

Abstract Number	**P-3-27-28**
Presenter	Agnes Psikuta*, René Rossi
Exposure	others
Health domains	other
Type of research	review

Role of the clothing in protection strategies and its implication for the physiological state of the wearer

Many human activities in outdoor and indoor spaces often require additional protection against adverse effects of the ambient environment (e.g. equipment, clothing, sleeping bag). One of the methods to provide an efficient barrier for excessive heat exchange and pollution ingress is wearing protective clothing, which properties should ensure protection of both health and comfort of a wearer. At the same time, garments and their volume constitute the closest microenvironment to the human body, and hence, provide the opportunity to adjust the environmental conditions efficiently right at the target instead of conditioning large volumes, e.g. large indoor spaces, warehouses, industrial spaces. This paper will present the perspective on the role of the clothing in protection strategies and its implication for the physiological state of the wearer as well as worldwide most advanced systems and methodologies for clothing research including thermo-physiological human simulators and 3D visualisation of air gaps in garments developed at Empa.

Abstract Number	**P-3-27-29**
Presenter	Chunla He*, Sonia Taj Anand, Sara E Wagner
Exposure	light
Health domains	cancer
Type of research	meta-analysis

shift work, light at night, and breast cancer risk: a meta-analysis

Background: The relationship between shift work or exposure to light at night and breast cancer risk in women remains unclear. Aims: To evaluate the statistical association between shift work or exposure to light at night, as surrogate markers of circadian rhythm disruption, and breast cancer risk through a comprehensive meta-analysis. Methods: The PubMed database was searched for observational epidemiologic studies on shift work or light at night and breast cancer risk published between January 1980 and December 2012. Publication bias was examined by funnel plot and Egger's test. Cochran Q test and I2 statistics were used to assess the heterogeneity. Pooled odds ratios (ORs) and 95% confidence intervals (CI) were calculated using random effects models for all studies. Subgroup analyses were performed to identify potential cause of heterogeneity. Results: A total of 22 studies were included in the meta-analysis. The pooled OR based on random effects model indicated a significantly positive association between shift work/light at night and breast cancer (OR=1.23; 95% CI 1.13-1.34). Subgroup analyses suggested that the pooled ORs did not differ significantly by study design, country of study, measures of association, or year of study. Conclusions: This analysis provides strong support for an association between exposure to shift work or light at night and an increased risk of breast cancer among women. Rigorous prospective studies are needed to confirm the relationship between these important circadian-disrupting exposures and breast cancer risk. Strategies decreasing circadian disruption caused by shift work and/or exposure to light at night may be beneficial to the prevention of breast cancer.

Abstract Number	**P-3-27-30**
Presenter	Hanns Moshammer*, Stana Simic, Jasmina Hadzimustafic, Philipp Weihs, Jochen Wagner, Michael Fitzka, Daniela Haluza
Exposure	UV radiation
Health domains	cancer
Type of research	others

Spatial and temporal predictors of melanoma incidence in Austria: Results of en ecologic study.

Objectives: Melanoma incidence increased in Austria in the last decades. Solar UV radiation increased until recently because of the damage to the ozone layer. With the restoration of the ozone layer UV radiation is predicted to decline again. If the increase in melanoma incidence were mostly due to the change in natural UV radiation we might expect declining incidence rates in the future. Exposure data: We assessed trends in UV annual cumulative doses at 9 fixed monitoring stations in Austria since 1961. There was strong inter-annual variation that was deemed not relevant for melanoma incidence. Apart from that, we observed an increase in annual cumulative UV dose of 1.2 kJ/m² per year consistently across stations. The only predictor of differences found between stations was the height above sea level with a gradient of 13.1 kJ/m² per 100 meter. Health data and methods: We obtained population data and melanoma incidences per 5-year age groups and gender for all 120 districts of Austria. We performed Poisson regression for each gender-age group with the gender-age specific population size as offset and year and height above sea level as predictor variables. Results: Averaged across strata melanoma incidence increased by 2% annually and by 20% per 100 m increase of height above sea level of the district. This fits well with the change in cumulative UV dose for these predictors. Effects were consistently stronger in younger age groups. Discussion and conclusions: Not only cumulative dose but also day-by day variability of UV radiation increased by year and by height above sea level with the strongest variation seen in summer. Since melanoma risk might be affected most strongly by peak exposures, for future scenarios not only cumulative average exposure but also variability and peak exposures would be of interest.

Abstract Number	**P-3-27-31**
Presenter	Jinliang Zhang*, Guoliang Chen, Fengzhu Tan, Xiujie Fang, Ling Liu, Xiuge Zhao, Xianliang Wang, Wei Meng
Exposure	no exposure
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Survey on Living Environment of Rural Residents in Central China

Aims: To deeply understand the living environment of rural residents in central China and to provide the basic information for rural environmental comprehensive management plans. Methods We chose 560 households and 560 family members as the subjects of household-spot observation and inquiring survey in 7 counties in central China. The survey and interview were implemented by trained observers. Results： According to the survey, households overall sanitation was general, and there were only 28.2% of households overall sanitation in good conditions; 59.8% of households kept free-roaming livestock and poultry,30.2%of households existed visible livestock feces;8.2% of households piled up their garbage randomly,47.9% of households discarded their sewage randomly, at the same time 27.4% of households dropped their sewage into the ditch and river directly; According to the survey biomass fuels (wood or straw) and coal remained the main cooking fuels in the rural area, accounting for 61.3% and 40.4% respectively;66.8% of the households used shallow groundwater in distributed supply,76.2 % of the wells located within 20m from the toilets, 47.5% of the wells located within 50m from the pool/ponds; the households hardly had sanitary latrines.27.2% of the toilets have no ceiling, 46.1% were not cleaned up. Conclusion: Household sanitation situation was not optimistic in the area surveyed. The proportion of the availability of cleaner fuel was low and there were risk factors affecting the safety of drinking water. Feces piled up in the open air and without harmless treatment, and many households discarded their sewage and piled up the garbage randomly. Key words rural residents; living environment; observations; health status

Abstract Number	**P-3-27-32**
Presenter	Mark Miller*, Gary Dahl, Christine Zachek, Patricia A. Buffler, Christopher Hsu
Exposure	no exposure
Health domains	cancer
Type of research	others

Translating Research in Environmental Health to Pediatric Practice: A Survey of Pediatric Hematologists and Oncologists

Translating Research in Environmental Health to Pediatric Practice: A Survey of Pediatric Hematologists and Oncologists Background: Clinical practice plays an important role in advancing children’s environmental health and preventing harmful exposures. While scientific studies have highlighted evidence of environmental contributions to childhood cancer incidence, we hypothesize that there have not been corresponding advances to incorporate this evidence into routine clinical practice. Aims:To assess environmental history-taking behavior and perceptions of environmental health among pediatric hematologists and oncologists. Methods:A web-based survey was conducted among 427 members of professional clinical networks across the country. Abstracts from the 2011-2012 American Society of Pediatric Hematology/Oncology (ASPHO) meetings were also reviewed to identify current clinical studies that investigate environmental risk factors. Results: The survey had a 45% response rate. Environmental exposures are of concern to clinicians, but a lack of familiarity or comfort in discussing these issues with patients' families presents a significant barrier. Although 76% of practitioners suspected some cases to have environmental etiologies, few asked about environmental exposures. Of the APSHO abstracts reviewed, less than 1% investigated environmental factors. Conclusions: This research implies a need for increased training and awareness of environmental health among pediatric practitioners, as well as a need for interventions related to improving environmental history-taking such as identifying behavior change strategies or incorporating self-administered intake questionnaires into patient care. By publishing research findings in journals that clinicians read, environmental epidemiologists can help bridge this knowledge gap and increase physician comfort in communicating research findings to patients.

Abstract Number	**P-3-27-33**
Presenter	Debra Kaden*, Sandy Sulsky, Linda Dell, Linda Hall, Elizabeth Miesner
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Understanding Cumulative Impacts in Assessing Community Exposures and Health

Both chemical and non-chemical stressors may impact the health of individuals and communities. New methods of accessing and integrating available exposure and health data are needed for risk ranking, prioritizing, and decision-making when evaluating new policies and development projects. Several new methods of assessing cumulative environmental stressors and health impacts on a community level have been developed. These methods are identified and reviewed, with emphasis on their ability to provide information on source-exposure and exposure-disease relationships. Human impact assessment and cumulative exposure methods may integrate more traditional health impact assessments with social impact assessment. Such methods take a holistic view to identify at-risk communities; consider exposures to both chemical and non-chemical stressors (e.g. physical, biological, social) across multiple exposure pathways; and assess effects on a range of health determinants for the population. They also incorporate qualitative/semi-qualitative data (e.g., general exposure indicators, severity rankings) and account for unequal accessibility to resources (e.g., health care, food, education, transportation). We contrast these newer approaches with traditional health risk assessment methods that focus on individual contaminants of concern and maximum exposed individuals. The opportunity to incorporate new tools and technologies, such as biomarkers and portable exposure monitors, will also be discussed, particularly as they provide opportunities for understanding the exposure-disease continuum. These new methods hope to allow comprehensive evaluation of potential health impacts of policies, programs, and projects on a community and the distribution of those effects within the population, allowing communities and policymakers to make informed choices related to potential risks and possibilities for risk reduction.

Abstract Number	**P-3-27-34**
Presenter	Luis Gerardo Caminos Serrano*, Arturo Curiel Ballesteros
Exposure	others
Health domains	policy
Type of research	others

URBAN SPRAWL, TRANSPORT AND VEHICLE ACCIDENTS IN GUADALAJARA'S METROPOLITAN AREA

URBAN SPRAWL, TRANSPORT AND VEHICLE ACCIDENTS IN GUADALAJARA'S METROPOLITAN AREA Caminos Serrano Luis Gerardo1, Curiel Ballesteros Arturo1 1Masters Program in Environmental Health, University of Guadalajara. Background Guadalajara's strong attraction with respect to its regional environment and the population saturation of its territory is reflected in the increase in population growth rates of its neighboring municipalities, showing a high-intensity urban expansion. Due to this urban sprawl, people drive more and pollute more. The increase in transfer times can be linked to increased risks associated to expanding cities (Frumkin, Frank, Jackson. 2004). Aims Confirm that urban expansion, has been instrumental in the increased rates of vehicle accidents. Methods In order to establish a value for urban sprawl, a central zone of compact built was taken as the point of reference and concentric circles were drawn from this point—all with equal areas—in order to confirm the manner in which urban sprawl has increased over the years. Established the location of each vehicular accident within the municipality in the area of concern. Results Urban sprawl is verified in some specific areas. Traffic accidents have occurred mainly on two of the roads. These roads were designed before the occurrence of this expansion and have recently been modified to incorporate the entrance and exit points to these areas. From 2005 to 2010, the number of inhabited homes doubled, from 50,989 to 105,954; the same was observed with respect to the number of automobiles, which increased from 23,535 to 42,375. Nevertheless, the number of accidents between 2005 and 2010 increased from 353 to 1,289; that is, it did not double but rather increased four-fold. The same holds for the number of deaths, which rose from 12 per year to 40 per year. Conclusions The increase in vehicle accidents in Guadalajara's metropolitan area is explained not by the population increase, but rather by a synergistic effect of urban sprawl.

Abstract Number	**P-3-27-35**
Presenter	Laia Font-Ribera*, Manolis Kogevinas, Cristina M. Villanueva
Exposure	water
Health domains	skin disease
Type of research	cross-sectional study

Water contact through showering and bathing and eczema among children living in an area with very hard water

Background: Some ecological studies have found a positive relation between water hardness and eczema in children. We previously found an increased risk of eczema among children attending pools in an area with hard water. This finding has not been found in other areas. Aim: We evaluated in the same children if individual activities related to water contact were associated with eczema. Methods: A survey was conducted in 3,223 9 to 12 yr-old children in Sabadell, in the eastern coast of Spain where water is very hard (>200 mg CaCO3/L). Parents completed a questionnaire on frequency and duration of showering and bathing. The outcome was having ever had eczema or atopic dermatitis. Potential confounders included gender, parental education, parental asthma, BMI and swimming pool attendance among others. Weekly minutes of showering or bathing was calculated, log transformed and categorized in quartiles to estimate the Odds Ratios (OR) and 95% Confidence Intervals (95%CI) of eczema. Results: Data on water contact was completed for 1,850 children. Eczema prevalence was 35% and increased with parental education and parental asthma. Median time of showering or bathing was 53 minutes per week (Interquartilic range = 38-88), and was longer in girls, children with lower parental education, high BMI and few siblings. Adjusted OR of eczema was 0.82 (95%IC=0.52-1.30) among children in the highest vs. lowest quartile of water contact time. No interaction was found between pool attendance, water contact through shower or bath and eczema prevalence. Conclusions: We detected a considerable individual variation in water contact time. Water contact through showering and bathing was not associated with eczema in children living in an area with very hard water. Future studies with individual data on water use among children living in areas with different levels of water hardness are needed.

Abstract Number	**P-3-30-01**
Presenter	Vorapat Inkarojrit*
Exposure	others
Health domains	infectious diseases
Type of research	health impact assessment

Assessing Environmental Control Strategy of Tuberculosis Infection in Thai Hospitals: Perspective from Architect

At hospital, inpatients and health-care workers (HCWs) are at particularly high risk of TB infection because of frequent exposure to patients with infectious TB disease. To minimize TB infection, WHO and US CDC have proposed three-level hierarchy of control including administrative control, environmental control and personal respiratory protection. While many HCWs are able to effectively implement the first and third strategies, the majority of HCWs, however, have difficulty implementing environmental control strategy. Therefore, the objective of this research are to gain more understanding on current environmental control practice in Thailand and to provide policy and technical proposal that foster environmental control implementation from a perspective of a non-health related profession. The research described in this paper is a part of a larger study on enhancing occupational health surveillance in Thai Hospitals which was funded by the Global Fund (Round 8) for fighting AIDS, Tuberculosis and Malaria and Thailand-US Centers for Disease Control and Prevention. To achieve the objectives, infection control practice of ten hospitals Thailand was surveyed during November 2009 – December 2012. Architectural and ventilation data were also collected from TB-related departments to confirm infection control practice. Results from gap analysis showed that common weaknesses lie at the lack of effective environmental control procedure and inappropriate operation/maintenance of hospitals' architectural features. The aforementioned weaknesses were found to be an impediment to developing necessary environmental control practices that address effective healthy indoor environmental quality. For conclusion, this research proposes an integrated approach to environmental control best practice involving consideration of the relationship between the building and environmental infection control practice which requires knowledge sharing between architect, engineer, and HCW.

Abstract Number	**P-3-30-02**
Presenter	Richard Gminski*, Irina Nazarenko, Alif Ali Tarib, Volker Mersch-Sundermann
Exposure	others
Health domains	other
Type of research	others

Biocombust

Background In recent years the European energy policy has changed from fossil to renewable CO2-neutral fuels in order to improve both the quality of life and the energy situation. The use of energy plants instead of traditional fossil fuels is one of the possibilities strongly supported in the Upper Rhine region in Germany, France and Switzerland. AimsOur international multidisciplinary project aims toexplore and to communicate the impact of fine-particle emissions form biomass combustion on air quality and heath. The expected results will provide a basis for technical and economic applications, supporting the improvement of environmental conditions and human health. Methods Biomass combustion results in the emission of VOCs, NOx, fine and ultrafine particles, whose effect on humans has not been well studied so far. Physicochemicals and mineralogical methods will be used to characterize the aerosol particles frombiomass combustion. In addition, we will focus on the characterization of potential biological effectsofparticulate emissionsand ashesfrom biomass combustion on humans. Using complex in vitro cell systems mimicking human lungs, we will assess the impact on cell viability, integrity of the lung tissue, and potential DNA damage providing evidence for possible tumorigenic effects. Moreover, we will investigate activation of transcription factors and formation of ROS. Expected results The results will include: (i)assessment of the impact of particulate emissions from biomass combustion on the local and regional air quality; (ii) improvement of our understanding of the potential impact of particles from biomass combustion on human health; and (iii) evaluation of the produced ash as a possible CO2-neutral clinker substitute for the regional cement industry. Conclusions The BIOCOMBUST project serves primarily to improve the life quality of the population in the Upper Rhine region, supporting a sustainable economic growth of the regional biomass industry.

Abstract Number	**P-3-30-03**
Presenter	Gilmar Sidnei Erzinger*, Luciano Henrique Pinto, Rafaela Sierth Sierth, Lineu Fernando Del Ciampo, Donat Peter Häder
Exposure	organic compounds
Health domains	physical activity
Type of research	exposure measurement

Changes in the behavior of algae Euglenas gracillis in the presence of 17? ethinyl estradiol and 17 ? estradiol in urban waste water.

Currently there has been growing concern about the contamination of water resources by pollutants "emerging." The Endocrine Disruptors (ED) derived pharmaceuticals, such as the fall of 17-β estradiol and 17-α ethynylestradiol on this condition. This question has been studied by researchers because little is known about the toxicological risk environmentalist and health of such compounds. There are currently several methods that aim to make the biomonitoring for the presence of urban wastewater of ED, such as tests involving genetically modified yeast or fish. The disadvantage lies in the first and second delay, the impossibility of extrapolating the environment to handle genetically modified beings. Changes in physical and physiological activities of microorganisms front ED have been widely studied for the characterization and use in biocontrol. This study investigated the changes in these activity algae of the genus Euglena gracilis in the presence of these hormones through the used of image analysis in real time through the equipment New Generation Ecotox and efficiency of photosynthetic capacity through PAM. In the presence of saturating light, the algae culture exposed to 17-β estradiol suffered changes in photosynthetic activity, an increase in the occurrence of non-photochemical dissipation NPQ. The concentration of chlorophyll in the presence of 17-β estradiol dissolved in a solvent that increase significantly over the period of 7 days. The concentrations of carotene also increased exposure to these hormones. With respect to physiological noted that the behavior of the algae front exposure of the hormones involved in modification of some parameters were significantly altered, such as average speed and ascent to the surface. These changes occurred mainly in the presence of 17-β estradiol These results point to changes that may be used for biomonitoring.

Abstract Number	**P-3-30-04**
Presenter	Hsing Jasmine Chao*, Meng-Fei Lee
Exposure	ambient air pollution
Health domains	allergies
Type of research	health impact assessment

Characteristics and Health Impacts of Ambient Bioparticles in Northern Taiwan

Background: Bioparticles are ubiquitous in our daily environments, including fungal spores, pollens, microorganisms, etc. Ambient bioparticles may induce respiratory tract inflammation or exacerbate allergic symptoms/diseases. Aims: We conducted a longitudinal study from 2005 to 2009 in northern Taiwan to examine the characteristics and health impacts of ambient bioparticles. Methods: The environmental samplings were conducted in Xinzhuang District, New Taipei City and Xin-Yi District, Taipei City. We monitored ambient fungal spores 7 days per month using Burkard seven-day volumetric traps. Ambient fine and coarse particulates were collected 2 weeks per season using high volume air samplers, and analyzed for endotoxin and fungal allergen (Cla h 1). Health data included numbers of daily outpatient visits for allergic diseases in the study areas. Results: The average level of fungal spores during the study period was 1686 spores/m3. The most prevalent fungal spores were ascospores, basidiospores and Aspergillus/Penicillium. Cla h 1 and endotoxin levels were higher in coarse particulates than in fine particulates in both sampling sites. The levels of ambient fungi and endotoxin had significant relationships with various air pollutants (e.g., fine and coarse particulates) and meteorological factors (e.g., temperature, relative humidity and rainfall). In multiple regressions, we found that hospital visits for allergic diseases were related to several bioparticles (e.g., Cladosporium, Stemphylium and endotoxin in fine particles) and environmental parameters (e.g., temperature, wind speed, rainfall and fine particles). Conclusions: This study provides important information on the characteristics and health risks of ambient bioparticles in the Greater Taipei Area. With increasing prevalence of allergic diseases in the world, our findings can provide essential information for the public to avoid allergen exposure and to improve their quality of lives.

Abstract Number	**P-3-30-05**
Presenter	Kadri Meister*, Christer Johansson, Bertil Forsberg, Lars Burman
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Effects of studded tire restrictions on the public health in Stockholm, Sweden.

Background: In northern Europe, coarse particle concentrations are generally elevated during winter and spring. In Stockholm, road pavement wear increases drastically during the winter due to the use of studded tires. Together with increased use of traction sand on streets, this contributes to high emissions of coarse particles and the exceedances of the EU limit values for PM10. In order to improve air quality with respect to PM10, a ban of studded tires on Hornsgatan, a densely trafficked street in the inner city of Stockholm, was introduced from 2010. Aims: The aim of this study was to quantify the importance of the ban of studded tires on the public health in the Greater Stockholm (approx. 1.63 million inhabitants). As health outcome we used number of premature deaths. In addition, we have calculated what a potential extension of restrictions could mean for the public health in the studied population. Methods: The effect from different situations on the air quality was modeled using a non-exhaust traffic emission model (the NORTRIP model) and a Gaussian dispersion model. We then used an exposure-response function for coarse particles of 1.68 % increase in daily mortality per 10 µg m-3 increase in coarse fraction, as obtained earlier for the studied population. Results: The ban has led to reduced use of studded tires not only on Hornsgatan but also other streets in the inner city and along arterial roads. The current situation is that 50% of cars have studded tires in the inner city and 60% along arterial roads, respectively. We estimated that 8 premature deaths per year were avoided in the Greater Stockholm metropolitan area due to the ban on one single street. For a potential future situation with fees on using studded tires resulting in 10% of all cars having studded tires on inner city streets and 50% on arterial roads, we estimated 15 fewer premature deaths per year in the study area. Conclusions: This study demonstrates the importance of making quantitative estimates of health impacts in order to justify actions to reduce air pollution.

Abstract Number	**P-3-30-06**
Presenter	Angelo Giuseppe Solimini*, Maddalena D'Addario, Antonio Di Lascio, Paolo Villari
Exposure	no exposure
Health domains	infectious diseases
Type of research	review

Going beyond boundaries: a systematic review of pathogens transmitted from men to animals and its global health impact

Background. The impact of globalization on the emergence and spread of pathogens is an important veterinary and public health issue. Pathogens transmitted from humans to animals are an understudied aspect of global health but have a large potential to cause significant disease burden in wild and domestic animal populations with important consequences for local economies. However, little is known about the health and economic impacts of the multidirectional exchange of pathogens among humans, wildlife, and domestic animals. Aims. We carried out a systematic reviews of papers reporting human to animals transmission published in the scientific literature. Methods. We review and summarise the evidence from studies that have reported a transmission of pathogen from human to animals either in private house, farm, zoo or wild environments. The search was carried out on two different online databases, cited reference searching, and related records screening. Results. We retrieved more than 4000 records that were screened for adherence to predefined inclusion criteria. The final selection include about 130 titles published from 1972 onwards. Most of the studies are classifiable as case studies, globally distributed across continents and deal with livestock, although pets and wildlife infections are also reported. Pathogens most often transmitted from humans to animals are H1N1 and H3N2 (36 papers), Methicillin-Resistant Staphylococcus aureus (43 papers) and Mycobacterium tuberculosis (24 papers) while the transmission of other pathogens like Herpes viruses, measles and other paramyxovirus seems more sporadic and unconfirmed. The method of assessment of man to animal transmission is a problematic aspects of those studies with molecolar typing and temporal criteria not always applied. Conclusions. We conclude advocating that more research is critically needed to fully understand the cross species routes of contamination between humans and animals and its mode of assessment.

Abstract Number	**P-3-30-07**
Presenter	Rasoloharimahefa Rasamoela Michele*, Catherine Bouland
Exposure	ambient air pollution
Health domains	other
Type of research	review

Health effects of chemical products: cleaning products and biocides

Background: Nowadays, cleaning products and chemical substances play a significant role in our daily life. The focus on the health effect of these products has been boosting due to the increasing time spent in indoor environments and also, the trend to decrease ventilation rates in buildings for energy conservation. The multiple, mixed sources of pollutants including building materials, biological, chemical pollutants and the vulnerability of some within the population, together represent a challenge. This cocktail contributes to a poor health at public health level. Aims: The aim of the study is to show contradictions in the use and the need for cleaning products in the framework of health impact to than give alternatives for respectful cleaning methods for health and environment. Methods: The literature review had been completed by an interdisciplinary approach with interviews of actors in the field of environment and/or health and hygiene. Results: The study shows different contradictions of the cleaning, biocide and other chemicals products application depending on the susceptibility of the person. The vulnerable groups were described in different context of the life, namely, household, school, childcare, nursing home, hospital, work place and public environment. Recommendations include that most of the life places do not need a biocide use except during epidemic infectious diseases. Conclusions: A limitation of the use of these products may protect occupants and prevent a potential resistance of the microorganism. There is a lack of data on this topic, it is clear that health impact of low emission of chemical product on vulnerable groups has to be further investigated within a holistic approach. Studies have to be done for realistic exposure condition and based on specific characteristics of the occupants (e.g. vulnerabilities).

Abstract Number	**P-3-30-08**
Presenter	Andrea Ranzi*, Carla Ancona, Paola Angelini, Ennio Cadum, Monica Chiusolo, Francesco Forastiere, Paolo Lauriola, Federica Parmagnani, Renato Pizzuti, Salvatore Scondotto
Exposure	waste
Health domains	policy
Type of research	health impact assessment

HEALTH IMPACT ASSESSMENT OF WASTE TREATMENT PLANTS ON THE RESIDENT POPULATION

Background: Waste management is a complex issue that involves different populations and thousands of workers in Italy. Integrated Environmental and Health Impact Assessment has been recently developed (www.intarese.org) also specifically for waste management. Aim: to develop methodologies and operational tools for the implementation of surveillance systems on waste and health, to assess the impact of the municipal solid waste management on health of exposed population. Methods: The activities focused on the evaluation of scenarios based on regional planning of waste management, and the estimation of health impacts resulting by the presence of waste disposal facilities in 5 regions (Emilia-Romagna, Piedmont, Lazio, Campania, Sicily). A baseline scenario (waste policy in 2008-2009) has been calculated, with percentages of use of different types of waste disposal: recovery, TMB, incineration, landfill. A simulated "green scenario" for 2020 has been identified according to the following criteria: 10% reduction of waste production, 70% recycling/composting, no landfilling of unseparated waste. The different impacts relating to these policies are being evaluated. Exposed population was estimated with GIS approach, defining as exposed people who lived around plants (3 Km for incinerators, 2 km for landfills, 500 meters for mechanical biological treatment [MBT]). Results: The population involved is 249573 for incinerators, 158222 for landfills, 2586 for MBT. Piedmont has the largest number of people living near of 20 landfills (71389), Emilia-Romagna near 8 incinerators (146280). Health impact assessments, using different indicators of health and risk functions developed in previous projects, has to be performed. Conclusion: The proposed methodology will allow the monitoring of the health status of populations living around waste disposal facilities and the assessment of impact of different policies.

Abstract Number	**P-3-30-09**
Presenter	Päivi Meriläinen*
Exposure	drinking water
Health domains	no health domain
Type of research	health impact assessment

Health risk assessment of chlorophenols in drinking water

Background: There are hundreds of chlorophenol (CP) contaminated old sawmill sites in Finland. CPs were a commonly used fungicide in timber from the 1940's until 1984. The main active components of the fungicide are CPs (60%). A municipality with 30 000 inhabitants in Finland was exposed to CPs in drinking water since the groundwater area was contaminated by a nearby old sawmill. Aims: The aim of this study was to perform a health risk assessment of CPs in drinking water in the study area. Methods: The risk assessment of CPs in drinking water done with the typical health risk assessment framework. Data from groundwater and drinking water concentrations was obtained from the local water treatment company as well as the CP removal efficiency of the water treatment. The chronic health effects taken into account were non-Hodkin's lymphoma and soft tissue sarcoma, and acute health effects were diarrhea, nausea and, itchin. Risk analysis was carried out with Monte Carlo based modeling. Results: The CP contaminated groundwater (CP average concentration 100 ug/L, sd 200 ug/L) is clearly a health risk to drinking water consumers. The average CP concentrations in raw water was 30 ug/L (sd 30 ug/L), however, the sand filtration removes up to 90 % of the CPs thus resulting under 1 ug/L concentration in the drinking water. This level does not cause health effects in the exposed population. Therefore the results of the risk assessment show that there were no excess cancer cases per year due to CPs in current exposure levels. Conclusions: CP exposure has been observed in old sawmill areas with high CP concentration which threatens the nearby groundwater and thus the population. In this study the exposure level was so low that no health effects were estimated due to CPs. Since there are hundreds of similar contaminated old sawmills throughout Finland, the results of this study can be applied elsewhere in similar cases.

Abstract Number	**P-3-30-10**
Presenter	Chia-Wei Lee*, Der-Jen Hsu, Chun-Nan Huang, Wei-Lun Lee, Hung-Bin Juo, Huey-Jen Su
Exposure	organic compounds
Health domains	reproductive outcomes
Type of research	health impact assessment

Health risk assessment of human exposures to phthalate esters in indoor dust from daycare centers, kindergartens and elementary schools in Taiwan

Background Phthalate esters (PAEs) exposure associated with harmful health effects has been raising public concerns. Results of the recent studies show that PAEs are ubiquitous indoors. Aims The major goal of the current study was to investigate the occurrence and concentration of PAEs in indoor dust from kindergartens (including daycare centers) and elementary schools in Taiwan and to assess human exposure and health risk to these PAEs. Methods Most of sampling sites were selected from Tainan and Kaoshiung cities.Samplings were conducted between January 2011 and December 2012. Fifty-five indoor dust samples were collected by vacuum suction from twenty schools and analyzed for six phthalates (DMP, DEP, DBP, BBP, DEHP, and DNOP) by GC-MS method. Results The major phthalate were DEHP (100% detected) and DNOP (100% detected) with median concentrations of 520 μg/g dust (range:14.2 - 42,397.1 μg/g dust) and 135.1 μg/g dust (range: 7.0 - 2,307.3 μg/g dust), respectively. The mean concentrations for DMP, DEP, DBP and BBP were 2.9, 4.8, 6.4, 1.9 μg/g dust, respectively. Total PAEs concentrations in indoor dust from element schools were relatively higher than that of kindergartens and daycare centers. Conclusions Estimated average daily doses of phthalates from ingestion, dermal and inhalation exposures are less than the reference doses (RfD) established by US EPA and tolerable daily intake (TDI) set by EFSA. The difference in exposure estimates between children and adults in this study supports previous reports that children are at greater risk from pollutants that accumulate indoors.

Abstract Number	**P-3-30-11**
Presenter	Etienne Cassagne*, Etienne Cassagne, Pascal De Giudici, Marie-Thérèse Guillam, Claire Ségala
Exposure	ambient air pollution
Health domains	equity
Type of research	review

Identifying environmental “hotspots” to reduce their impact on health: a methodological review

Background: Relationships between health and environment are a major topic in international and national policies. In France, it was formalized by the first national health and environment plan (PNSE1), in 2004, which was followed by the PNSE2 (2009), with their regional versions (PRSE1 and 2). Aims: The main goal was to respond to the action 6 of the PRSE2 of Ile-de-France i.e. identifying environmental “hotspots” to reduce their impact on health. Methods: The research focused on an inventory of the studies on environmental inequalities in the developed countries, and on a detailed analysis of each stage of their methodology. Results: 25 studies were reviewed including 18 dealing with environmental justice or inequalities’ analysis. The environmental data used are mainly related to air pollution: outdoor pollutants and proximity to polluting facilities. The other ones include noise, health-related indices, annoyance data or “positive” factors as access to greenspaces. Environmental Index constructions are very different from one study to another. This variability is due to the data type used (more diversified in European than in U.S. studies), their normalization (discretization, standardization among others), the importance of each environmental field (weighted or not) and the use of socioeconomic and health data (directly included or “simply” correlated). The geographical dimension is always highlighted through cartography with, in many cases, GIS methods. Conclusions: No conceptual methodology of hotspots’ identification emerges. In each case, authors respond to local needs regardless of the applicability of the methods out of the study area. But, it allows us to propose methodological stages to comply from the definition of an environmental “hotspot” to the choice of the most suitable identification methods for Ile-de-France as well as other areas. This work was supported and piloted by DRIEE-IF and ORS Ile-de-France.

Abstract Number	**P-3-30-12**
Presenter	Joan Forns*, Mònica López-Vicente, Mikel Esnaola, Mar Álvarez Pedrerol, Jordi Julvez, Jordi Sunyer
Exposure	no exposure
Health domains	neurodevelopment
Type of research	health impact assessment

Neuropsychological assessment in the BREATHE project: preliminary results

Background: The BREATHE (brain development and air pollution ultrafine particles in school children) project aims to discover the effects of urban air pollution on neuropsychological development. Aims: We aimed to study the relationships between the different neuropsychological measures of the BREATHE project. Methods: A follow-up with four repeated evaluations of the cognitive performance in children aged from 7 to 9 years at baseline has being conducted during the period from January 2012 to March 2013. We evaluated 2.735 children using two different computerized paradigms: n-back task (to assess working memory) and attentional network task (ANT) (to assess attentional networks). Attention Deficit and Hyperactivity Disorder (ADHD) symptomatology (DSM-IV) and school achievement of children were reported by teachers. Parents filled in the Strenghts and Difficulties Questionnaire (SDQ). Parental sociodemographic variables were also collected by questionnaire. We analyzed the bivariate associations between outcomes and ADHD, SDQ and some covariates. Furthermore, the relationships between all the neuropsychological variables were studied using Bayesian Networks. Results: We observed that those children with higher ADHD symptomatology, higher behavioral problems (SDQ) and lower school achievement performed significantly worse the n-back task. We also observed four main paths in the DAG analyzing the interdependencies between variables: ADHD, behavioral problems (SDQ) and two paths for n-back scores. All of these paths showed dependence with maternal education and school achievement subsequently. Conclusions: These preliminary results indicate that n-back scores seem to be more sensitive than ANT scores to some important variables such as child's age, maternal education, ADHD symptomatology and behavioral problems. However, n-back score distributions are independent from those variables assessing ADHD symptomatology and behavioral problems.

Abstract Number	**P-3-30-13**
Presenter	Claire Petit*, Séverine Deguen, Ari Rabl, Annabelle Lapostolle, Benoît Lalloué, Wahida Kihal, Cindy Padilla, Tarik Benmarhnia, Pierre Chauvin, Denis Zmirou-Navier
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

NO2 ambient air levels differently affect life expectancy according to social deprivation: an analysis across census blocks in Paris

Background A number of cohort studies have assessed the long-term effects of air pollution on mortality, but few tried to evaluate whether the loss of life expectancy was influenced by the socioeconomic characteristics of the population. Aims We estimated the loss of life expectancy associated with NO2 ambient air levels across census blocks of different socio-economic characteristics using a method that allows to derive long term effect measures from time series data on all-cause mortality. Methods Cases of deaths that occurred after 35 years of age in the city of Paris, France, were available from January 2004 to December 2009 and daily NO2 concentrations from January 2002 to December 2009 were estimated at the census block scale (about 2,000 inhabitants). We aggregated the daily NO2 concentrations and the deaths counts in all the census blocks of the same social deprivation category (n=3). After having de-seasonnalized and de-trended the time series of NO2 concentrations and death counts, we performed a multivariate linear analysis between the risk of mortality against the "2nd difference" of the NO2 concentration until lag 730 (over 2 years), following the method proposed by Rabl et al (2011). The loss of life expectancy was represented by the estimation of the 730th coefficient of regression. Results We found a loss of life expectancy (LE) of 94 days per 10 µg/m3 increase of NO2 concentrations (95% confidence interval = [85-102]) over the entire population. When stratified according to the social deprivation categories, we observed a higher loss of life expectancy among the most deprived areas (LE=103 days [88-118]) than in the most privileged ones (LE=86 days [67-106]). Conclusions We applied an innovative method to assess the loss of life expectancy based on time series data. This estimation is probably a lower bound because the lag period is "small" (2 years). Even though, we found a higher loss of life expectancy in the most deprived areas.

Abstract Number	**P-3-30-14**
Presenter	Monika Filipsson*, Anna Augustsson, Magnus Fagergren
Exposure	no exposure
Health domains	no health domain
Type of research	others

Perception of uncertainties and quality in risk assessments by people working with risk assessments

Background About 80,000 possible contaminated sites have been identified in Sweden. Assessing the risk posed by these sites and, if necessary, remediating the soil is associated with high costs. It is thus important that these assessments are reliable. A problem with current methods is that uncertainty and variability are often not accounted for. Different individuals have different physiology and behaviour and soil composition differs at various sites which can be considered in probabilistic methods. This requires tools that are user-friendly and cost and time-efficient. Information about the perception of risk assessments, uncertainty and tools wanted by people working with risk assessments is therefore needed. Aims The aim of this study is to investigate whether people working with risk assessments in practice find that these assessments are of sufficient quality, whether it is important to consider uncertainty and variability and which tools they may need to be able to consider these questions. Methods A questionnaire was sent to people working with the risk assessment of contaminated sites at government authorities and consultancies in Sweden. Results The data collected suggest that the majority of respondents find that risk assessment quality in general would need to be improved. Important factors to achieve this include a greater knowledge of the individuals involved in risk assessments, more financial resources, greater knowledge in form of new research and more time. The respondents also find it very important to characterize both uncertainty and variability, and to do this several respondents want more tools such as literature and databases with information about critical exposure factors and manuals. Conclusions According to personnel involved in the risk assessment of contaminated sites, the quality of the assessment should be enhanced and different tools would be useful to facilitate the characterization of uncertainty and variability.

Abstract Number	**P-3-30-15**
Presenter	Charu Jhamaria*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Prediction of Long Term Health Impacts at Sensitive Areas by Air Quality Monitoring at Jaipur City India

Prediction of Long Term Health Impacts at Sensitive Areas by Air Quality Monitoring at Jaipur City India Charu Jhamaria Sr. Assistant Professor and Additional Head Department of Environmental Science The IIS University Jaipur India cjhamaria@yahoo.com Background Much of the population of India lives in areas where the concentration of air pollution reaches levels that adversely affect health. For this purpose, air quality monitoring was conducted near sensitive areas i.e. three major hospitals of Jaipur city. Aims of the study The major aim of the study was to evaluate the major air quality parameters at the major hospitals of the city namely SMS Hospital, T.B. Hospital and Janana hospital and predict the impact on human health due to the poor air quality. Methods The study was conducted for four seasons(Summer, Pre moonson, post moonson and winter season) to monitor four air quality parameters, Suspended particulate matter(SPM),Respirable suspended particulate matter(RSPM),Sulphur Dioxide(SO2) and Nitrogen Dioxide(NO2) using high Volume Sampler(Envirotech APM 460 BL) with gaseous attachment(Envirotech APM 461). Results The results for all the parameters at all the study sites were alarming. The average levels of suspended particulate matter (SPM) and Respirable suspended particulate matter(RSPM) was highest during the winter season at SMS hospital with a value 563 µg/m3and 332 µg/m3respectively as compared to the permissible limits of 100 µg/m3 for SPM and 75 µg/m3 for RSPM. Similarly values for SO2 and NO2 were also high at SMS hospital during the winter season which ranged between 157 µg/m3 and 176 µg/m3 respectively as compared to the permissible limits of 30 µg/m3. given by CPCB for sensitive areas. Conclusion The results of all the parameters show high levels of the air pollutants which are a major concern as they are responsible for various respiratory and cardiovascular diseases along with other adverse effect on human health. Key Words: suspended particulate matter, sensitive areas

Abstract Number	**P-3-30-16**
Presenter	Tanya Turnovska*, Gergana Foreva, Donka Dimitrova, Radost Asenova, Rositsa Dimova, Rumyana Stoyanova, Valeri Serafimov, Stanka Chokova, Vanya Tancheva – Mancheva, Georgi Tsigarovski, Rada Boyadzhieva
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	health impact assessment

PROJECT FOR TRAINING TO GENERAL PRACTITIONERS ON THE ENVIRONMENTAL HEALTH

PROJECT FOR TRAINING TO GENERAL PRACTITIONERS ON THE ENVIRONMENTAL HEALTH Background. The position of the general practitioners and the specifics of their specialty allow them not only to diagnose and treat, but also to carry out active preventive activities. The general practitioner is expected to be aware not only of disease manifestations, but also of any living environment conditions. Another key competence of theirs is related to patient's health problem solving organization by means of coordination with other medical and non-medical institutions. The submodule of teaching of the general practitioners (GP), related to environment and health problems is not included in the national program of the Ministry of Health in Bulgaria. The aimof this work is to present a demonstrative project for GP advanced training on the risky problems, related to air pollution and health. Methods: Development of a project related to the 'environment and health' problem within the context of the general medical practice by a team working at the Faculty of Public Health of the Medical University – city of Plovdiv. Results: The team included representatives of the National Environmental Protection Agency so that the so called 'hot points' to be identified, in this case – the points where the values of the controlled atmospheric pollutants are increased. This allowed for the inclusion of ten randomly selected general practices, located in the 'hot points' and of an appropriate control group.The group of indices using the generally adopted health indicators are: mortality, morbidity rate, hospitalization, emergency aid call, etc. Conclusion: The demonstrative project has the following peculiarities – a multiinstitutional system is formed, consisting of academic community, experts working at the National Environment Research Agency and general practitioners, which jointly, on the basis of the scientific and research work, provide advanced training on the risky problems related to health and air pollution.

Abstract Number	**P-3-30-17**
Presenter	Heather Patterson*, Pete Robinson
Exposure	others
Health domains	policy
Type of research	health impact assessment

Rapid Screening of Lower Concern Substances for Human Health Screening Assessments under the Canadian Environmental Protection Act (CEPA 1999)

Background The rapid screening approach facilitates the further prioritization of substances for assessment under the Canadian Environmental Protection Act, 1999 (CEPA 1999) by rapidly identifying those substances that may have a higher or lower potential for concern based on hazard or exposure considerations. The approach also helps focus resources on higher priority substances by rapidly identifying those that are not of concern. Methods and Results Given the reported quantities in commerce in Canada (≤ 1000 kg) of these substances, indirect exposure to the general population from environmental media (air, water, soil) is not expected to be significant. Certain uses, may however, result in direct exposure. The term "direct use" refers to the use of a chemical substance that is directly, or as part of a mixture, a product, or a manufactured item, sold to or made available to Canadians for their use. A user is considered to be anyone from the general public who has access to a product that is advertised, imported or sold in Canada. To determine if a substance is used in, or present in a product used by Canadians, a number of domestic and international resources were consulted. Based on information identified from these sources, as well as other available information on the substance, it was determined that substances with the potential for direct exposure to the general population include those that are present, either intentionally or unintentionally, in products or manufactured items that are commonly used by Canadians. Using this rapid screening approach the Government of Canada was able to identify, and conduct a screening assessment for over 500 substances Conclusion The rapid screening approach has demonstrated that it can be used as a mechanism to efficiently deal with large numbers of substances in an efficent, timely, and scientifically defensible manner, while meeting the requirements under CEPA (1999) to conduct screening assessments for substances which met the categorization criteria set out in the Act.

Abstract Number	**P-3-30-18**
Presenter	Sunali Khanna*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Rhino Sinusitis and Air Quality: The Radiological and Health Assessment

Background : Increased consumption of fuels to meet the ever increasing demands of the growing population coupled with increased industrial growth has adversely affected the air quality, especially in commercial hubs like Mumbai(most populated metropolitan city). However, the particulate matter levels have risen exponentially from 2006 to 2008 which is a cause of concern. The disruption of the mucus can have an effect on the sinuses draining and nasal mucosa and they may become clogged and obstructed which can lead to rhinosinusitis. Aim:Evaluation of radiological and clinical parameters in rhinosinusitis and their interlinkages with the urban air quality in parts of Mumbai city. Methodology: Air quality assessment was carried out in various parts of the city of Mumbai. Orthopantomographs (OPG) formed part of the study to gauge the extent of sinus involvement. The data was statistically analysed. Results: The population examined showed significantly high rates of sinus disease.Radiography is one of the best investigations to study Maxillary sinusitis. Orthopantomograph (OPG) is the radiographic technique preferred because of its low cost and low patient exposure. Radiographic changes primarily an increase in mucosal oedema /thickness and/or opacification were interpreted. Conclusion: The conclusion drawn out show majority of cases of rhinosinusitis show radiologic evidence, especially the urban people, probably on account of pollution and urban air quality. A complex environmental problem like air pollution when ignored beyond a limit has far reaching effects on the health of the population. It is important that we tackle such grave issues with swift and effective measures. The concerted efforts of the community would reduce the severity, if not completely eliminate, environment related disorders like rhinosinusitis

Abstract Number	**P-3-30-19**
Presenter	François Pouzaud, Valérie PERNELET-JOLY, Marion Keirsbulck, Guillaume Boulanger, Pierre-André Cabanes, Corinne Mandin*
Exposure	others
Health domains	respiratory disease
Type of research	health impact assessment

Setting of chronic indoor air quality guideline for nitrogen dioxide: Evidence-based approach using epidemiological studies.

Background The French Agency for Food, Environmental and Occupational Health Safety (ANSES) has been developing indoor air quality guidelines (IAQG) since 2005. These guideline values correspond to safe levels of indoor pollutant concentrations below which adverse health effects are not expected to occur in the general population, including sensitive groups. Aims In 2010, the World Health Organization (WHO) proposed a chronic IAQG for nitrogen dioxide at 40 µg.m-3 associated with a 20% increased risk of lower respiratory illness in children. This value was not in accordance to the Anses definition of IAQG due to the associated adverse health effects. In this context, the Anses IAQG working group proposed a methodological approach based on corroborating evidence to set a long term IAQG for nitrogen dioxide. Methods An extensive analysis of available epidemiological studies was conducted, including those of the WHO monograph (2010) and those published afterwards. Associations between indoor exposure to nitrogen dioxide and the development of various respiratory effects are documented in epidemiological studies conducted in several countries worldwide.Relevant key studies were selected following several criteria: study conducted in indoor environment, assessment of relationship between NO2 exposure and chronic respiratory health effects on children (susceptible population). Each selected study was deeply analysed, in particular the NO2 exposure characterisation, the health effects assessment and their relationship. Results Eight epidemiological studies related to indoor air were selected as key studies with critical effects based on chronic respiratory health effects on children. The critical analysis of these studies allowed describing some consistent evidence to corroborate NO2 levels associated with the absence of respiratory effects among this subpopulation. Conclusions Anses proposed an IAQG of 20 µg.m-3 for nitrogen dioxide, protecting from chronic respiratory health effects.

Abstract Number	**P-3-30-20**
Presenter	Sophie Haesen*, Esther Schelling, Solveig Danielsen, Eric Boa
Exposure	others
Health domains	healthrelated quality of life
Type of research	review

Synergies between Human, Animal and Plant Health

Background: The veterinarian Calvin Schwabe described as One Medicine linkages of veterinary medicine and human health that strengthen cooperation between human and animal health professionals and improve provision of health services. The terms One Health and EcoHealth were coined for the interplay of human, animal and ecosystem health. Healthy plants are essential for healthy animals and humans, but plant health and its linkages to human and animal health have rarely been described or trialed. Plantwise, an initiative led by CABI, helps establish community-based plant clinics to improve food security and reduce crop losses. Harmonization of the three health services might increase performance and health status of humans, animals and plants, with positive socioeconomic consequences particularly in remote rural areas. Aims: To describe the human, animal and plant health systems in rural Uganda and identify synergies and benefits of their closer cooperation. Methods: A systematic review on the structure and mandates of the human, animal and plant health systems to conceptualize a framework between them. The main linkages are described qualitatively by stakeholders (smallholder farmers, NGOs, researchers, health workers, administrative staff) in a rural context of Africa within a transdisciplinary approach. The selection of districts is based on agricultural livelihoods and an active network of plant health clinics. Identified synergies are evaluated and quantified by a questionnaire survey. A trial to test the most prominent joint intervention will be outlined. Expected results: An evaluation of synergies between human, animal and plant health systems that can be tested to describe benefits of closer cooperation. An established shared framework on these that facilitates the identification of further practical linkages. This approach should be valid for Uganda and any environment where smallholders depend on extension services for the health of household, livestock and crops. The framework and survey results will be presented.

Abstract Number	**P-3-30-21**
Presenter	Shiro Ikeda*, Hideaki Sekine, Yoshika Sekine
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Synergistic and Hormetic Effects of Volatile Organic Compounds on Marine Luminescent Bacterium Vibrio fischeri

Various chemical contaminants present including unknown and unidentified pollutants in indoor environment. These toxicities as mixture have not been evaluated with any regard for the possibility of serious impacts on the environment. This study aimed to find the influence on bioluminescence of luminescent bacterium Vibrio fishceri, when typical indoor air pollutants (VOCs) were mixed, compared with the case of single components. Bioassay using V. fischeri is well known as a novel screening method for toxicity evaluation of the environmental contamination. Both single and mixed VOC solutions by two kinds of VOCs were prepared in various concentration levels with dilution by methanol as a solvent. Acetaldehyde, formaldehyde, toluene and ethyl benzene were tested as typical VOCs. Each sample solution (50 µL) was mixed into 2 mL of reactivated bacterial solution in a well of 24-well plate. Then, time course of relative bioluminescence intensity (BLI) was measured by a luminometer with blank and positive control solution. Then, EC50 of single components were obtained from dose-response curves and mixed toxic properties were evaluated with mixture toxicity index, MTI. As a result, every mixture showed significant increasing or decreasing of toxicity compared with the cases of single VOCs probably because of synergistic effect. On the other hand, biostimulation was observed in the low concentration ranges of each VOC, even these components remarkably inhibited the bioluminescence at high concentrations. This result probably indicates the hormetic effect for VOCs. This study suggests that some combinations of VOCs have more serious or trivial impacts on marine luminescent bacterium than previously recognized.

Abstract Number	**P-3-30-22**
Presenter	Bing Wang, Jinliang Zhang*, Yangshen Zhang, Libo Pan, Ling Liu, Xianliang Wang
Exposure	metals
Health domains	mental health
Type of research	health impact assessment

The estimation of health risk for lead exposure of children in China

Aims: To understand the BLLs of Children and to estimate the children's disease burden of mild mental retardation (MMR) due to lead exposure in China. Methods: Through Chinese Biomedical Disk (CBMDisk), Chinese Journal Full-test Database (CJFD) and other source, we searched and collected articles on children's blood lead levels (BLLs) published from 1994 to 2012. Then we selected the eligible articles by two senior researchers after rigorous reviewing. The articles were divided into two groups based on subjects' living area, namely urban children and rural children. Finally, the incidence rate of mild mental retardation (MMR) and disability-adjusted life years (DALYs) of children due to lead exposure were calculated by WHO recommended methods. Results: The average BLLs was 7.26μg/dl and the rate of MMR was 18.1‰ for urban children, 7.88μg/dl and 19.8‰ for rural children, respectively. The DALYs caused by lead exposure were 39.4 per 1000 person for urban children and 43.2 per 1000 person for rural children. Conclusion: All those suggested that the incidence rate of MMR caused by lead exposure in China was higher than that of WprB. Keywords: children; blood lead; disability-adjusted life years (DALYs); mild mental retardation (MMR)
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Abstract Number	**P-3-30-23**
Presenter	Carlos José Sousa Passos*, Frédéric Mertens, Robert Davidson, Christine Romana, Marc Lucotte
Exposure	others
Health domains	other
Type of research	others

The PLUPH Project: an environmental health study based on ecosystem approaches to human health (Ecohealth) in the Brazilian Amazon

Over the last years, deforestation for small-scale agriculture has been associated to a number of health problems in vulnerable populations of the Amazon. For instance, slash-and-burn agricultural practices have been not only favoring the transfer of natural soil mercury (Hg) into aquatic ecosystems resulting in the contamination of local fishing resources, but also increased the environmental risk of Chagas infection (American Trypanosomiasis), resulting from the proliferation of Attalea palm trees following deforestation, this palm being the main forest ecotope for triatomine insect vectors of Trypanosoma cruzi, the pathogenic protozoan. The PLUPH project (Poor Land Use, Poor Health) http://www.pluph.uqam.ca - is supported by the Canadian Global Health Research Initiative and has been conducted by Brazilian, Canadian and French researchers using these two environmental health emergent problems as pretexts to address primary prevention of human health through sound land-use for small-scale farmers, all of this on the basis of an ecosystem approach to human health (Ecohealth). It fully integrates socioeconomic, political, cultural, and gender aspects with biophysical dimensions of the Tapajós watershed region, an active pioneer front where both old riparian communities and newly settled inland colonies are found. We initially mapped the basic epidemiologic system of the American Trypanosomiasis in the study area, identifying Attalea local species, their degrees of infestation by triatomines, levels of T. cruzi infection in insects, and their dispersion among such palms. In parallel, we characterized the transfer of Hg from terrestrial to aquatic environments according to different land use strategies and assessed human exposure to this contaminant taking into account socioeconomic and cultural factors (e.g., local dietary habits). The scientific results of our participatory research are now applied to design sustainable agroecosystems and used to promote education, modes of rural development and public policies in the Amazon, combining population health and environmental protection.

Abstract Number	**P-3-30-24**
Presenter	Jiun-Horng Tsai*, Jin-Hong Ju, Yung-Chen Yao
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Uncertainty in Health Impact Assessment of Organic Air Toxics from Refinery – A Case Study in Taiwan

Background Petroleum refinery is one of major sources of NMOGs in Taiwan which contributed 2.3% emissions among all stationary sources. Estimation of the toxic may affect significantly on health risk assessment due to the different emission factor selection. Aims This study investigates the procedure for health impact assessment organic air toxics released from a refinery in Taiwan. Six emission source categories, including stack, equipment component, storage tank, flare, loading/unloading, and wastewater treatment plant, in refinery were discussed. Methods NMOG emissions from each category were calculated by applying WebFIRE and SPECIATE 4.0. Facility priority for target air toxics was evaluated. The ISCST3 model was used to simulate the ambient concentration. Result Total of 31 VOC species were identified by using emission factors in WebFIRE and SPECIATE 4.0. The results show that the top air toxic is benzene. The results of facility priority of carcinogenic effect showed the highest score is flare. The scores of flare, equipment component, wastewater treatment plant, and storage tank are higher than 10 and will be classified as high priority facility. The ambient concentrations of four selected organic air toxics were simulated. The maximum annual concentration of benzene was 183 µg/m3. The maximum total cancer risk for target air toxics is 7,120×10-6. Benzene is most important compound (6.91×10-3) and followed by ethylbenzene (2.10×10-4). Conclusions The case study in Taiwan indicates that air toxic emission profile selection causes the greatest variation on health impact assessment among those relevant factors in a refinery. .

Abstract Number	**P-3-30-25**
Presenter	Larisa Privalova*, Boris Katsnelson, Vladimir Gurvich, Sergei Kuzmin
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Use of animal experiments with engineered nanoparticles for health risk assessment and management

A general methodology of setting safe or reference exposures (RfE)-to nanoparticles (NPs) is still lacking, and in most cases the risk assessment and risk management are implemented with qualification that safe exposure limits for individual NPs are not available. The precautionary approach is that of choice in the NPs-exposed worker's health protection, but search for toxicological substantiation, even if tentative, of RfE- NPs should be intensified. To this end, we carried out short term and sub-chronic animal experiments with microparticles and NPs of Fe3O4, Ag, and Au proving the following: · Although NPs are far more toxic as compared with their micro-counterparts, the organism is able to recruit the usual physiological defences against the former even more efficiently than against the latter, the inference being that safe exposures levels are possible in principle. · There are no reliable foundations for establishing different RfEfor NPs of different size but they should depend on the NP's chemical nature. For NPs toxicologically characterized RfE-NPs can be proposed based on sufficiently conservative approach of decreasing by approximately one

Abstract Number	**S-1-06-02**
Presenter	Riana Bornman*
Exposure	persistent organic pollutants
Health domains	other
Type of research	others

DDT: Poison or Life Saver: Presentation

Pro side: While DDT has been heavily implicated in disastrous environmental consequences due to its large and indiscriminate use, the case for a continued use in malaria control is rather different. A strong case can be made that DDT is, along penicillin, one of the molecules that has saved most lives in the history of modern public health. Most of the malaria control effort during the period 1950-1970 was based on DDT spraying and it prevented millions of deaths. Evidence of toxicity to humans is still controversial, but available evidence suggests that if such an effect exist, they can not be large. In one instance at least (in South Africa), the discontinuation of DDT for malaria control led to a major malaria epidemic, while the switching back to DDT allowed the control effect to be regained. Undoubtedly, good public health practice requires that an exception for the limited and targeted use of DDT for malaria control should remain. Con side: Millions of people live in dwellings that are sprayed indoors every year at 2 g m2. This translates into 64-128 g per year per dwelling. This means that inhabitants are almost continuously exposed to high levels throughout the year. It cannot be disputed that DDT as used in indoor residual spraying is effective in preventing malaria transmission. The question remains however: Is DDT safe? Many recent publications on human health have found reasons for concern due to association with adverse human health effects, including such as Type 2 diabetes, altered hormones, cancer, lowered birthweight, and changed sperm parameters. Evidence from the environment in DDT-sprayed areas in South Africa (eggshell thinning, imposex in fish, and apparent absence of aquatic birds) is consistent with information of human endocrine disruption from the same area. So should DDT use therefore continue?

Abstract Number	**S-1-08-01**
Presenter	Aneta Wierzbicka*
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Characteristics of particles from indoor sources

Indoor sources can periodically generate particles that in number and mass concentrations frequently exceed levels measured outdoors. Assessment of characteristics of particles from indoor sources can be challenging due to their high variability, intermittent nature and site specificity. In real residences assessment of the indoor or outdoor origin of particles, their characteristics and dependence on occupants' activities are not easy. In general much less is known about particles from indoor sources than about ambient particles. This can be explained by limitations of instruments suitable for measurements on population representative scale in private homes where minimal disturbance in daily occupants' activities is crucial. Recent advances in small, portable and silent instruments open up new possibilities to assess time resolved characteristics of particles from indoor sources and their contribution to personal exposure on relatively larger scale. Scattered information about particle characteristics of selected indoor sources, based on measurements in limited amount of residences and chamber experiments, are available although are far away of giving a complete picture. Physical properties and chemical composition of indoor particles are not fully understood. Information about size resolved composition and toxicity of indoor particles, despite their importance in assessment of dose and potential health effects, are unknown. Recently, limited studies have reported that the contribution of indoor sources to daily residential (while at home) ultrafine particle number exposure accounts on average to about 50% ranging from 19 to 76%. The results highlight the importance of indoor sources in assessment of personal exposure. In general, not only particles of ambient origin should be considered in assessment of potential health effects but also particles from indoor sources. More data is needed on indoor particle characteristics and their role in personal exposure.

Abstract Number	**S-1-08-02**
Presenter	Otto Hänninen*, Pasi Lipponen, Riikka Sorjamaa
Exposure	ambient air pollution
Health domains	other
Type of research	exposure modeling

Counterfactual behaviour of ultrafine particles in infiltration and lung deposition processes

A commonly used justification of concern for ultrafine aka nanoparticles is their high deposition probability in the alveolar region of human respiratory tract. This is often phrased as 'capability of penetrating deep in the lung'. While the higher probability of an ultrafine particle being deposited in the alveolar than other regions of the lung is well established, it is also clear – yet not as widely recognized - that the deposited mass in the alveolar region is almost certainly dominated by larger particles, as the particle masses increase much more rapidly as function of particle size than the deposition probability decreases. However, it is easily forgotten that infiltration process also significantly modifies the ambient particle size distribution due to the particle size driven differences in the penetration and deposition rates indoors. The objective of the current work is to quantitatively compare these processes using a previously developed and evaluated particle size dependent infiltration model and the ICRP (1994) model for respiratory tract uptake. The results show that time spent indoors substantially modifies the uptake of ultrafine particles. Human doses to ambient ultrafine particles are to a very large extent obtained outdoors and in traffic environments, while the PM2.5 uptakes are dominated by indoor environments. As a consequence time-activity variables are likely to be sufficient for qualitatively estimating the impact of ambient ultrafine particles on health in epidemiological settings. Indoors exposure and uptake of ultrafine particles takes place by accumulation mode carriers; i.e. the ultrafine particles are partly attached to larger particles, which in the accumulation mode size range effectively transports them indoors. Indoors mass uptake is dominated by accumulation mode as also coarse (super micron) particles are effectively removed from the breathing air by the building envelope and subsequent indoor deposition.

Abstract Number	**S-1-08-03**
Presenter	Steffen Loft*, Dorina Gabriela Karottki, Michal Spilak, Marie Frederiksen, Barbara Kolarik, Elvira V. Bräuner, Torben Sigsgaard, Lars Bo Gunnarsen, Peter Møller
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure measurement

Health effects related to indoor ultrafine particles

Health effects of outdoor particulate matter are well described. Toxicology and some epidemiological evidence particularly point to strong effects of combustion-related ultrafine particles (UFP) explained by high alveolar deposition, poor clearance, insoluble carbon core, large surface area, adherence of toxic compounds, such as metals and PAH and potential translocation. Outdoor UFP penetrate indoor, where multiple sources generate UFP as well. However, little is known with respect to the possible specific health effects associated with indoor UFP. A few home or personal monitoring studies have found associations between outdoor and indoor UFP numbers and biomarkers related to health effects, including oxidative stress-induced DNA damage in leukocytes, inflammation and vascular activation. Indoor intervention with HEPA air filtration is a direct way to assess the effects of indoor UFP, although particles with larger size are also reduced. Using this design we found improved microvascular function, indicative of the risk of cardiovascular disease, after 48 hours filtration reducing UFP numbers from 10,000 to 3,200/cm3 among 41 healthy elderly subjects in a double-blind randomized controlled study. Similar results have been obtained using this design in a wood-smoke impacted community, although indoor UFP levels were not reported. Recently, we repeated the intervention design but extended to 2 weeks air filtration and 2 weeks of placebo filtration with health marker measurements at baseline and day 2, 7 and 14 of each scenario among 48 elderly subjects. However, we found no effect on microvascular function, lung function or biomarkers of inflammation, vascular activation or lung cell damage associated with UFP reduction from median 7,600 to 5400/cm3. In conclusion, indoor UFP are likely to have important adverse cardiopulmonary effects. However, well characterised and probably substantial exposure gradients in well-designed studies are required for documentation.

Abstract Number	**S-1-08-04**
Presenter	Man Pun Wan*, Christopher Chao, Chili Wu
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Indoor generated ultrafine particles in Hong Kong homes

Due to small sizes, ultra-fine particles (UFP) play a weak role in mass concentration in indoor particulate matters (PM), but in many cases, dominate the number concentration and contribute significantly to the surface area concentration. Studies indicated that exposure to UFP has the potential to cause severe adverse health effects. Indoor human activities including cooking, cigarette smoldering, vacuum cleaning and incense burning are some of the major sources of UFP. This study experimentally investigated the emission rates of UFP of these activities. The particle number concentrations and size distributions were measured using a scanning mobility particle sizer (SMPS) in a test chamber and a residential kitchen with these activities on-going. The UFP emission rates were then determined using a material balance approach. It was found that cooking (stir frying and pan frying) had the highest emission rates amount the four investigated types of activities. It was also observed that the emission rates differ significantly from different cooking styles and type of food cooked. In order to investigate the possible exposure to UFP by home occupants due to cooking emissions, site measurements of UFP concentrations and size distributions in different parts of the homes during and after cooking were conducted in 12 naturally-ventilated homes in Hong Kong. Chinese-style cooking was practiced in these homes. It was observed that cooking elevated the average number concentrations of UFP by 10 fold in the living room and by 20 – 40 folds in the kitchen. UFP emitted from cooking in the kitchen quickly dispersed to the living room and the UFP concentrations remained elevated in the living room up to 60 minutes after cooking had been finished. UFP concentrations in the living rooms during cooking were much higher than that in the outdoor, indicating that better ventilation could be an effective way to reduce UFP exposure due to cooking in homes.

Abstract Number	**S-1-08-05**
Presenter	Gerard Hoek*
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	others

Short term effects of ultrafine particles during commuting

Experimental studies have shown that human exposure to ultrafine particles may provoke substantial physiological respiratory and systemic responses. Results of epidemiological studies of associations of variation of 24-hour average UFP exposures with daily variation of respiratory symptoms, hospital admissions and mortality have not shown consistent results. This may be due to measurement error related to the use of a central outdoor monitor to characterize exposure. Recent monitoring studies have shown high ultrafine particle concentrations during commuting, related to motorized traffic emissions. Concentrations during commuting were much higher than observed at fixed monitoring stations. Several studies have now added examination of health effects to the monitoring while commuting. As these studies have measured exposures directly near the subjects, there is much less exposure measurement error compared to traditional time series studies based on central site monitoring. Studies that have measured personal ultrafine particle exposure during commuting and assessed a range of health effects have been conducted in Oxford street (London), Utrecht and Arnhem (the Netherlands), Brussels (Belgium), Copenhagen (Denmark) and Barcelona (Spain). Studies involved healthy volunteers, Health effects evaluated included lung function, airway inflammation, oxidative stress and biomarkers of cardiovascular responses. Overall, significant associations between ultrafine particle exposure and respiratory health parameters have been reported. An issue in the interpretation of the studies is whether the observed associations are due to ultrafine particles or other correlated components of motorized traffic emissions.

Abstract Number	**S-1-13-01**
Presenter	I-Jen Wang*, Shoei-Loong Lin
Exposure	others
Health domains	allergies
Type of research	cross-sectional study

Environmental exposures and the development of childhood allergic diseases

Background: Environmental factors may play a role to the increment of allergic diseases.Since the onsets of allergic diseases are relatively early in life, identification of environmental factors among genetically susceptible children are of critical importance. Aims: We conducted a Taiwan Childhood Environment and Allergic diseases Study (TCEAS) to investigate which environmental exposure could initiate sensitizations and predispose individuals to the development of allergic diseases. Methods: A total of 3192 kindergarten children in Taipei were recruited by stratified systematic sampling. Skin prick tests for mite, cockroach, animal dander, milk, egg, and crab allergens were performed. Information about the development of allergic diseases and environmental exposures by standardized questionnaires were collected. Multiple logistic regressions were performed to estimate the association between environmental factors, allergen sensitizations, and the development of allergic diseases after adjusting for potential confounders. Results: There were 485 (15.2%) children with AD, 1126 (35.3%) with AR, and 552(17.3%) with asthma. Of all the risk factors collected, children with environmental tobacco smoke exposure and fungi at house wall had a higher risk of asthma with OR (95%CI) of 1.25(1.03-1.52) and 1.22 (1.01-1.47). Of all the allergens tested, mite sensitization rate was found to be the highest. Mite sensitization showed a significant increase in the risk of AD, AR, and asthma with OR (95%CI) of 2.15(1.53-3.03), 1.94(1.46-2.58), and 2.31(1.63-3.29), respectively. Cockroach sensitization also increased the risk of asthma with OR(95%CI) of 2.38(1.01-5.61). Mite sensitization was associated with carpet at home and fungi at house wall while milk sensitization was associated with duration of breast feeding. Conclusions: Environmental exposures play a role in the development of allergic diseases. Early environmental interventions are important to stop the atopic march.

Abstract Number	**S-1-13-02**
Presenter	Bing-Fang Hwang*, Ya-Hui Chen, Yung-Ting Lin, Xiao-Tang Wu, Yungling Lee
Exposure	ambient air pollution
Health domains	allergies
Type of research	cohort study

Gender Differences of Long-Term Exposure to Fine Particle and Ozone in Lung Function Growth.

Background: There are only a limited number of studies on the association between long-term exposure to ambient air pollutants and lung function growth among children, which, nevertheless, leave inconclusive results. Aim: To assess the effect of air pollutants on lung function growth. Methods: We conducted a prospective cohort study of 3,207 Taiwanese children aged 12 at baseline followed from October 1, 2007 through November 31, 2009. The final study population comprised 2,941 non-smoking children who completed lung function tests at both baseline and follow-up surveys. We applied spatial modeling for individual-level exposure assessment to clarify the role of potential community-level confounding. The exposure parameters were yearly average and calculated from the 24-hour PM2.5, and 10:00 AM to 6:00 PM 8-hour O3 corresponding to residential address over the 2-year follow-up period. The effect estimates were presented as annul deficit of lung function growth per interquartile ranges (IQR) for PM2.5 and O3. Results: In a multiple linear regression adjusting for confounding, deficits in FVC, FEV1, and MMEF growth were associated with exposure to PM2.5 and O3. The annual deficits in FVC of 75 ml in boys and 61 ml in girls increased with an IQR PM2.5 (17.92 μg/m3), and annual deficits in FVC of 54 ml in boys and 40 ml in girls increased with an IQR O3 (3.59 ppb). Similar associations were found in FEV1, and MMEF growth. Conclusions: The study provides evidence that long-term exposure to PM2.5 and O3 may increase the risk of deficit in FVC, FEV1, and MMEF growth among Taiwanese children, especially among boys.

Abstract Number	**S-1-13-03**
Presenter	Carl-Gustaf Bornehag*
Exposure	gene-environment interactions
Health domains	allergies
Type of research	cohort study

Early life exposure for endocrine disrupting chemicals and the risk for asthma and allergy in children

We are focusing on environmental risk factors for asthma and allergy in children in two studies; the dampness in buildings and health (DBH) and the Swedish environmental, longitudinal, mother and child, asthma and allergy (SELMA) study. In the DBH-study we are following more than 10,000 children from early life up in school age. A major focus has been on suspected endocrine disrupting chemicals (EDCs) such as phthalates that are used in building materials (e.g., PVC) and consumer products. We have shown that PVC flooring in the homes bedrooms is related to indoor dust concentration of phthalates and to uptake of phthalates in infant children. We have further reported that PVC flooring in the home in early life is associated to allergic diseases in both cross sectional and longitudinal (incidence) data. Finally, we have reported associations between the bedroom dust concentration of phthalates and allergic outcomes in children. With these findings as a ground we are now focusing on asthma and allergy in the SELMA study. The SELMA study provides an extensive dataset including biological samples stored in a biobank (urine/serum from 1st trimester, cord blood, urine form the child at 2 and 12 months of age), environmental samples stored frozen (air and dust from the home the during pregnancy and infancy period), questionnaire data from eight times (2 times during pregnancy and at 2, 6, 12, 18, 48 and 72 months of age of the child), and access to data from the routinely made health examinations of the children at the County Council of Värmland. Overall aim is to examine the importance of prenatal exposure for EDCs for chronic diseases/disorder in offspring children (www.selmastudy.se) including immunological outcomes of asthma and allergy. We now have data on 1st trimester exposure for 10 phthalates, 2 phenols and 8 perfluorinated compounds and we will conduct a health examination of 2,000 children at the age of 6 years including sampling for genetic/epigenetic analyses.

Abstract Number	**S-1-13-04**
Presenter	I-Jen Wang*
Exposure	others
Health domains	other
Type of research	others

Epigenetic modification of atopic disorders after phthalate exposure

Background: Evidence has shown that phthalates may increase the risk of atopic disorders in children. However, the mechanisms underlying these effects remains to be addressed. Genesfrom toxicogenomics database may shed light on these pathways. Objectives: To assess the effect of phthalate exposures and atopic disorders on epigenetic changes of genes in exposed children. Methods: Children whose parents brought them to clinics because of diethylhexyl phthalate (DEHP) contaminated food events in Taiwan in 2011 were recruited. Information about atopic disorders and IgE levels were collected. Urine phthalate metabolites including MEHP were measured as an indicator of exposure. Fifteen human candidate genes interacting with phthalatesfrom toxicogenomics database with CpG islands (ESR1, ESR2, AR, PGR, THRB, PPARA, PPARG, CYP1A1, CYP1B1, CYP19A1, VEGFA, MAPK3, IL-4, RXRA, and LAMP) were selected. Initially, 22 blood samples were measured by quantitative PCR assays. Candidate genes with differential methylation between high and low exposures identified through the screen were further investigated in a larger sample. Correlations between the methylation percentage of target genes, phthalate exposure, and IgE levels were assessed by linear regression analysis. Results: Significant differential methylation between high and low phthalate exposures were found. This work is currently underway and complete results will be available at the ISEE conference. Conclusion: The effect of phthalate exposures may be mediated through alterations in DNA methylation.

Abstract Number	**S-1-13-05**
Presenter	Wilfried Karmaus*, Hongmei Zhang, John W Holloway, Hasan S Arshad, Susan Ewart
Exposure	others
Health domains	respiratory disease
Type of research	cohort study

Maternal smoking during gestation, differential DNA methylation, and changes in lung function at age 18 years

Background: DNA methylation (DNA-M) is considered to constitute an archive of past exposures, which may link gestational exposures with child and adult health outcomes. Aims: In a birth cohort followed into early adulthood, we explored whether epigenome-wide DNA-M in peripheral blood cells is related to intra-uterine exposure to maternal smoking 18 years earlier and whether differentially methylated cytosine-phosphate-guanine dinucleotide (CpG) sites are associated with lung function in adolescence. Methods: Genome-wide DNA-M was assessed using the Illumina Infinium HumanMethylation450 BeadChip, which interrogates >484,000 CpG sites. We focused on DNA-M in 245 female participants at age 18, who were randomly selected from the total cohort. A training-testing procedure was used to optimize the identification of methylated CpG sites. Forced expiratory volume (FEV1), forced vital capacity (FVC), and the FEV1/FVC ratio were measured in children of the Isle of Wight birth cohort at age 18. Current smoking and cotinine urine levels were ascertained at age 18 years. Results: In utero cigarette smoke exposure was associated with statistically significant differential methylation, particularly of CpG sites of the cytochrome P450 aryl hydrocarbon hydroxylase (CYP1A1), aryl hydrocarbon receptor repressor (AHRR),contactin-associated protein-like 2 (CNTNAP2), and myosin 1G (MYO1G) genes. For instance, the methylation of the CpG site cg17924476 of the AHRR gene was increased in relation to gestational smoke exposure. In turn, controlling for height and active smoking, differential methylation of cg17924476 of the AHRR gene was associated with a statistically reduced FEV1/FVC ratio (range 62-100%). The FEV1/FVC ratio was diminished by 2% per increase of DNA-M of 10%. Conclusions: In utero smoke exposure seems to establish long-term memory via DNA methylation leading to a higher susceptibility for diminished lung function at age 18 years of age.

Abstract Number	**S-1-15-01**
Presenter	Charles Weschler*
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure modeling

Physical-chemical properties governing the distribution of organic compounds in indoor environments

Background: In indoor environments organic compounds redistribute from their original source to other indoor “compartments”, including air, airborne particles, inanimate surfaces, human surfaces and settled dust. Aims: The aim of this talk is to examine the physical-chemical properties that govern the distribution of semi-volatile organics between dust, air and surfaces. Methods: Mass –balance considerations are used to develop simple equilibrium models that can be used to estimate the partitioning of an organic compound between the gas phase and other indoor compartments. A compound’s octanol/air partition coefficient, Koa, as well as the fraction of organic matter in dust and airborne particles, are key parameters affecting this partitioning. Results: For organic compounds that have meaningful gas-phase concentrations, modeled estimates of their distributions between dust and airborne particles are in reasonable agreement with measurements, and gas-phase concentrations predicted using dustborne mass fractions, fraction of organic material in dust and Koa correlate reasonably well with measured gas-phase concentrations. However, for organics with larger values of Koa, there may be insufficient time for equilibration among the different indoor compartments. Discrepancies between measured and predicted partitioning can also occur for organics that are present in dust primarily as a consequence of abrasion or wear processes. This includes organics with negligible gas-phase concentrations (e.g., BDE-209). Conclusions:In the case of organic compounds thatare associated with settled dust primarily via a sorption process, their levels in indoor dust are expected to scale with their levels in indoor air, airborne particles and surface films. In central tendency, we can make a first approximation of a person’s indoor exposure to a semi-volatile chemical via inhalation, dermal absorption and dust ingestion from the mass fraction of that chemical in dust.

Abstract Number	**S-1-15-02**
Presenter	John C. Little*
Exposure	household air pollution
Health domains	allergies
Type of research	exposure measurement

Ashes to ashes, dust to dust – how airborne particles affect the fate of SVOCs in the indoor environment

Background: Semi-volatile organic compounds (SVOCs), including phthalates, flame retardants and biocides, are present in many indoor products. Human exposure to some of these SVOCs is associated with adverse health effects. Airborne particles enhance emission rates of SVOCs from indoor products, play an important role in the transport of SVOCs in the indoor environment, and contribute to inhalation exposure to SVOCs. Less well understood is the potential for particles with sorbed SVOCs to substantially increase the potential for dermal sorption. Also, airborne particles contribute to the accumulation of dust, which is an important determinant of exposure to some SVOCs via ingestion. Aims: The aim of this talk is to experimentally demonstrate the enhancing effect of airborne particles on emissions of SVOCs from indoor products and to use the results to estimate the potential enhancing effect of airborne particles on exposure to SVOCs via inhalation, dermal sorption and the ingestion of dust. Methods:An experimental chamber is used to measure emissions of di-2-ethylhexyl-phthalate (DEHP) from vinyl flooring, with ammonium sulfate particles introduced to examine their influence on the emission rate. Simple mechanistic models are then used to quantify the potential influence of airborne particles on exposure to SVOCs. Results:Particles introduced to the experimental chamber increased the total airborne (gas + particle) DEHP concentrations by a factor of between three and eight, illustrating a clear potential for enhanced exposure. Conclusions:Airborne particles strongly influence the fate and transport of SVOCs in the indoor environment, and this mechanism must be considered when evaluating exposure and human health effects.

Abstract Number	**S-1-15-03**
Presenter	Thomas Webster*
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Exposure to Flame Retardants via Dust

Background: PBDEs and their replacements are semi-volatile organic compounds (SVOCs) added to consumer products as flame retardants (FRs). They are widely found in indoor dust and in human biomonitoring studies, sometimes at quite high levels. Aims: These compounds provide a model for human exposure to SVOCs in the indoor environment via dust and related pathways. Methods: A series of studies have examined the empirical relationships between concentrations of FRs in dust (as well as surface wipes and air) from various indoor microenvironments, handwipes (a measure of personal exposure), and biomarkers of exposure in serum or urine. Studies have also examined variation of dust concentrations over time and within buildings, and their relationship with building characteristics. Results: On average, PentaBDEs are distributed in dust, surface wipes and indoor air as expected based on physical-chemical properties. The much less volatile BDE209 is not in approximate equilibrium; evidence suggests it can enter dust via friability of products. Handwipes can combine exposure across microenvironments and are modifed by handwashing. PentaBDE serum levels are more closely related to handwipes than to dust; this does not appear to be due to excretion via skin. Dust concentrations for alternative FRs now approach or exceed PentaBDE levels. While exposure biomarkers are only available for only a few of these less-studied emerging compounds, evidence suggests that similar empirical relationships may exist between dust, handwipes and serum/urine. Discussion: For many SVOC flame retardants, a main route of exposure appears to be contact with dust or surface films followed by hand-to-mouth behavior, particularly for children. For compounds with approximate equilibrium partitioning, many existing dust/wipe collection methods should perform adequately. Differences from these patterns exist for flame retardants on both the more volatile and less volatile ends of the spectrum.

Abstract Number	**S-1-15-04**
Presenter	Gerhard Heinemeyer*, Stefanie Klenow, Astrid Heiland, André Conrad, Dirk Wintermeyer
Exposure	household air pollution
Health domains	no health domain
Type of research	meta-analysis

Re-evaluation of house dust intake rates

Background: The estimation of exposure to a certain substance has to take into account all exposure pathways. Particularly young children ingest dust particles because of their so called mouthing behavior whereby dust is ingested by licking dust loaded products or hand-to-mouth contacts. Therefore, substances that can be found in house dust (non-volatile or low-volatile compounds) are important at this particular age. Exposure estimates via house dust intake are usually performed with the help of default assumptions based on tracer studies concerning soil intake: in various studies values between 20 and 200 mg have been derived and suggested for daily house dust intake. Anyhow, this approach is affected by a number of assumptions and uncertainties. Aims: (1) to collect and evaluate existing information on commonly used default values for house dust intake rates and their scientific background, (2) to update default values for house dust intake, if possible, based on current studies, (3) to identify and evaluate knowledge gaps that should be addressed to improve defaults, and (4) to design a study concept that addresses those gaps of knowledge. Methods: In this study the idea is touse toxicokinetic information as well as human biomonitoring data in order to derive an improved estimate of house dust intake. This approach requires the selection of (a) suitable tracer(s) that should occur predominantly in house dust, which is systemically available and will be excreted via urine as a chemically stable compound and/or by known metabolites. Information on substances that have been measured in house dust will be evaluated for possible use in toxicokinetic modeling. Discussion: This study will assess the possibility of updating the dust ingestion rates that are currently used for exposure estimation on the basis of new scientific information.

Abstract Number	**S-1-15-05**
Presenter	Christiaan Delmaar, Martine Bakker*, Natalie von Götz, Andreas Gerecke
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure modeling

Modeling the contribution of the house dust pathway to consumer exposure

Background: In the risk assessment of substances used in consumer products, human exposure to a substance via house dust has often been suggested as a potentially important pathway. To date it is still unclear for which substances, products and uses this pathway is indeed relevant in comparison to the direct pathways and which are the determining factors of relevance. Aim: The CEFIC LRI sponsored DustEx project aims to systematically address the question of relevance of the house dust pathway for the exposure of consumers to substances emitted from consumer products. Methods: Exposure via the house dust pathway will be compared to other pathways such as direct dermal and oral exposure and exposure via indoor air. An integral source-to-dose method is developed to estimate total exposure of substances emitted from consumer products. This method is used to make a comparison of exposure via the different pathways for a range of product and substance combinations, taking into account the variability in exposure factors. Uncertainty in the modeling and parameters is addressed by performing a range analysis. Results: Preliminary outcomes of a scenario-based evaluation of the relative importance of the house dust pathway to consumer exposure are used to specify critical scenarios, products, substance properties and populations. Conclusions: Based on a preliminary evaluation, boundaries of the domain for which house dust is a relevant pathway can be indicated in terms of substance properties (e.g. range of log octanol/air partition coefficients), products and exposure scenarios and populations. The results will be used to guide the refinement of further research in the DustEx project, focusing on key scenarios' parameters and uncertainties.

Abstract Number	**S-1-15-06**
Presenter	Philippe Glorennec*
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

French children's exposure to pollutants via ingestion of indoor dust

Background. Well identified for lead, dust ingestion has arisen as an exposure pathway of growing interest for other metals and semi-volatile organic compounds (SVOCs). Aims. Several research programs have been implemented in France to collect data on indoor exposure to lead, other metals, and SVOCs. Dust ingestion is one of the considered exposure pathways, in an integrated exposure perspective. Methods. Nested in a national lead exposuresurvey, a sub-sample of 484 children (6 months to 6 years) was constituted in order to obtain representative data for young French children. In each home indoor settled dust was sampled by a wipe in up to five rooms. As, Cd, Cr, Cu, Mn, Pb, Sb, Sr, and V were analyzed by ICP-MS after acid digestion. In addition, vacuumed dust from household vacuum cleaner has been collected. A part of these dust samples have been analyzed by GC-MS for semi volatile organic compounds including phthalates, polybromodiphenylethers, organochlorines, pyrethroids. Concentrations were estimated by taking into account the sampling design and the sampling weights. Published dust ingestion rates will be used to estimate pollutants intake via dust. Discussion. Keypoints to estimate children's pollutant intake via house dust from vacuumed and wiped dust will be discussed, including: children selection, sampling location, sampling technique, sample preparation before analysis, dust ingestion rate. Methodological choices will be discussed with respect to objectives but also with technical issues such as dust loading and consistency with dust ingestion rates when using wipes as dust sampling technique.

Abstract Number	**S-1-18-01**
Presenter	Daniel Pope*, Eva Rehfuess, Kirstie Jagoe, Mukesh Dherani, Nigel Bruce
Exposure	household air pollution
Health domains	no health domain
Type of research	meta-analysis

Impacts of Improved Cooking Stoves (ICS) on Household Air Pollution (HAP) Concentrations and Personal Exposure

Background: In the short/ medium term, ICS offer the best opportunity for reducing HAP, but due to ICS design, household and cultural differences there is much variability in HAP exposure. Aim: To systematically synthesise evidence describing the impact of ICS interventions (biomass and clean fuels) on HAP exposure. Methods: A systematic review (published and grey literature) and meta-analyses of ICS interventions in low/ middle income countries to estimate "real-life" effectiveness in terms of HAP reductions. Standard review methodology (search, extraction and quality) appraised studies of the impact of ICS on HAP (carbon monoxide (CO) and respirable particulate matter (RPM)). Absolute mean differences (24hr) in kitchen and personal exposure were assessed using meta-analysis for ICS with and without chimneys, advanced combustion, mixed interventions, ethanol fuel and gas. Sensitivity analysis considered duration of intervention and study design. Results were compared to WHO AQG IT-1 level for PM2.5 and COppm. Results: There was much heterogeneity in HAP exposure between and within ICS groups. For kitchen HAP, pooled reductions for ICS with chimneys (21 studies; 24 estimates) were -0.50 mg/m3 (95% CI -0.64; -0.35) for RPM and -5.4 ppm (95% CI -7.3, -3.6) for CO; for ICS without chimneys (5 studies; 7 estimates) reductions were -0.26 mg/m3 (95% CI -0.39, -0.12) for RPM and -3.4 ppm (95%CI -4.8, -2.0) for CO; for advanced combustion ICS (3 studies and estimates) reductions were -0.22 mg/m3 (95% CI -0.38; -0.06) for RPM and -3.16 ppm (95%CI -5.59, -0.73) for CO; for ethanol ICS (2 studies; 4 estimates) reductions were -0.58 mg/m3 (95% CI -0.92, -0.24), for RPM and -21.9 ppm (95% CI -27.4, -16.5) for CO. For mixed ICS (2 studies) and LPG (1 study) lack of data precluded meta-analysis. For personal HAP, pooled reductions could only be calculated for ICS with chimneys (6 estimates); RPM -0.15 mg/m3 (95% CI -0.24, -0.06) and CO -1.4 ppm (95% CI -2.0, -0.9). Sensitivity analysis did not effect pooled estimates. Conclusions: Whilst the majority of ICS were still well above WHO AQG IT-1 levels for PM2.5 many were below new guidelines for 24hr COppm.

Abstract Number	**S-1-18-02**
Presenter	Kalpana Balakrishnan*, Sankar Sambandam, Santu Ghosh, Thangavel Guruswamy, Krishnendu Mukhopadhyay, Vidhya Venugopal
Exposure	household air pollution
Health domains	other
Type of research	health impact assessment

Implementing the recommendations of the WHO Indoor air quality guidelines to address household air pollution: a country perspective from India

Background: The WHO Indoor Air Quality Guidelines (IAQGs) developed in 2013, provide for the first time, technology specific guidance to meet the interim and guideline targets for specific criteria air pollutants associated with household cookfuel use. This will allow many developing countries including India, to evaluate alternative intervention options to reduce household air pollution exposure against the interim targets and develop plans to reach guideline values in the long-term. Aim: To highlight special considerations in the application of the WHO IAQGs to address air pollution exposures from household cookfuel use in India. Methods: We provide an overview of the household air pollution status in India from a systematic literature review and a India specific modeling exercise executed as part of the GBD 2010 exercise. We describe implications of household cookfuel use on ambient air quality (currently estimated to account for 25% of the outdoor particulate matter load). We also track important new evaluations of cleaner combustion (biomass) cookstoves and cleaner fuel options and provide comparative analyses of factors influencing their adoption from case studies in multiple states. Results &Conclusion: The new estimates for the burden of disease attributable to household air pollution in India includes contributions from indoor and outdoor exposures. The use of the WHO IAQGs with the previously provided pollutant specific AQGs affords a unique opportunity to include household air pollution under the ambit of existing standards. We highlight the need to initiate intervention efforts beyond small scale programs covering individual households in select communities to include large scale and high density efforts involving cleaner technologies at the state or national levels. Substantive reorganization of current programs is imminently needed to make progress towards achieving air quality standards described by WHO AQGs in India.

Abstract Number	**S-1-18-03**
Presenter	Michael Johnson*, Rufus Edwards, Lidia Morawska, Mark Nicas, Kirk R. Smith
Exposure	household air pollution
Health domains	respiratory disease
Type of research	exposure modeling

Linking stove performance and policy: the emissions model

In order to guide decision-making in selecting potential stove interventions, a model was applied which defines the emission rates required to meet WHO intermediate targets and AQGs for PM2.5 and CO. The model used was a single zone model, a relatively simple construct which requires few assumptions and has been widely applied in air pollution and climate research. As homes relying on solid biomass vary considerably in their physical characteristics and energy demands, a probabilistic Monte Carlo approach was used to account for this variability. Specifically, the model used input distributions of kitchen volumes, ventilation rates, daily usage times (time the stove was lit), and emissions capture efficiency (for chimney stoves) to produce output distributions of mean 24 hour PM2.5 and CO concentrations. The resulting output distributions were then compared with WHO targets and AQGs to estimate what percentage of homes would meet or exceed these levels. Emissions performance of the best currently available solid biomass technologies suggest that improvements in PM2.5 emission rates are needed for at least half of the homes using both unvented and vented stoves to meet the interim-1 annual AQG for PM2.5 (35µg m-3), while meeting the 24hr CO AQG (7 mg m-3) could be achieved by the majority of homes using these stoves. Meeting the final PM2.5 AQG (10µg m-3) would require substantially greater emissions rate improvements for solid biomass stoves, although the use of clean-burning gas and liquid fuels such as LPG, natural gas, biogas, and ethanol, as well as electricity, represent technologies which can provide high levels of protection immediately. Finally, efforts are underway to provide a user friendly platform of the model, for which input distributions based on local conditions can be applied, and thus more regionally targeted emissions rate guidance can be provided.

Abstract Number	**S-1-18-04**
Presenter	Kirk R. Smith*, Aaron J. Cohen, Nigel Bruce
Exposure	household air pollution
Health domains	respiratory disease
Type of research	health impact assessment

Policy implications of new exposure-response evidence

Background: Indoor air pollution concentrations in households (HAP) span a wide range from those with open solid fuel combustion, averaging many hundreds of µg/m3 of PM2.5 over the year in poorly ventilated conditions, to relatively clean levels in homes using gas or electric heating and cooking devices. To assess the health risk remaining at each level above the WHO AQGs requires understanding the exposure-response relationships over far greater exposure ranges than are available from any one epidemiological study available today. As part of the GBD Project Comparative Risk Assessment (CRA) , a set of integrated exposure-response (IER) functions were developed that link risks across more than three orders of magnitude in exposures from epidemiologic studies of combustion particle exposures from active and secondhand tobacco smoking, outdoor air pollution (OAP), and HAP. These are being considered for informing the development of the IAQGs. Methods: We briefly review the current state of development of the IERs for several important disease endpoints and their potential use in the IAQGs. Results: There have been three major uses of the IERs for informing policy. The main impetus for their development by the OAP CRA was to determine risks at exposure levels higher than available in the OAP epidemiologic studies. The main use by the HAP CRA was to interpolate risks for cardiovascular endpoints for which there is evidence at higher (active smoking) and lower (secondhand smoking/OAP) exposures, but no direct evidence yet for HAP. In addition, it was used to enable risk estimates in comparison to a common low counterfactual for both HAP and OAP. Conclusions: It has been proposed to use IERs to estimate the benefits of alternative interventions at different points along the exposure axis. We explore the potentially counterintuitive implications of doing so that arise because of the highly supralinear shape of most of the IERs and offer some ways forward.

Abstract Number	**S-1-18-05**
Presenter	Eva Rehfuess*, Adair-Rohani Heather, Annette Pruss-Ustun, Carlos Dora, Nigel Bruce
Exposure	household air pollution
Health domains	equity
Type of research	review

Rationale and methods for new WHO indoor air quality guidelines: household fuel combustion

Background: Household air pollution (HAP) from fuel combustion has been linked in the GBD 2010 study to 3.5 million premature deaths, plus 0.5 million due to contributions to outdoor air pollution. Building on prior WHO specific pollutant air quality guidelines (AQG), this new project will compile evidence on household emissions and health impacts, to provide practical recommendations to help countries secure these health benefits. Aim: To summarise existing WHO indoor AQGs, describe what the new guidelines will add, and give an overview of methods used for reviewing the strength of available evidence. Methods: All WHO Guidelines follow rigorous procedure to ensure recommendations are evidence-based and free from conflict of interest. Systematic reviews and a revised approach to GRADE were used for all evidence informing recommendations. The guidelines are global, but give emphasis to low and middle-income countries where the disease burden is greatest. Results: Systematic reviews cover topics representing elements of the causal chain extending from fuels used in homes for cooking, heating and lighting, through emissions from alternative stove/fuels (measured and modelled), exposure levels experienced, health risks, and intervention impacts on HAP, exposure and health. Burns and poisonings are reviewed, reflecting growing concern about injuries from household fuel use. Reviews also cover factors influencing intervention adoption, costs and approaches to financing – including carbon finance - in line with the emphasis for WHO guidelines to support implementation. GRADE methods were modified to deal better with the mix of laboratory, observational, quasi-experimental, RCT and other evidence available, and examples will be described. Conclusions: The continuing high disease burden from HAP demands strong and effective action. These new WHO guidelines will provide recommendations based on a rigorous assessment of evidence, laying the basis for effective action.

Abstract Number	**S-1-19-01**
Presenter	Clive Sabel*
Exposure	others
Health domains	healthrelated quality of life
Type of research	others

Climate change and health in urban areas – an integrated methodology

Abstract This paper is designed to set out the context and methodology for the remainder of the symposium, of research being carried out by the EU FP7 funded URGENCHE project, investigating the impacts on health and wellbeing of climate change causing greenhouse gas (GHG) reduction policies. The symposium aims to report findings at a very practical scale – that of cities. In fitting with the conference theme bridging north, east, south and west, our project work is in collaboration with five European partner cities (Kuopio, Finland; Rotterdam, The Netherlands; Stuttgart, Germany; Basel, Switzerland and Thessaloniki, Greece) carefully chosen to represent a good north-south and east-west range, with the addition of two cities in China (Xi'an and Suzhou). Our speakers are drawn from both research active and city policy backgrounds. The project explores themes on energy supply and demand, housing and transport. In terms of health, the project focuses on non-infectious health outcomes - including respiratory and cardio-vascular health, but also on positive health outcomes such as wellbeing as potential co-benefits of GHG reduction policies. Our GIS-based methodology takes into account the advances made in integrated environment and health assessment in a large range of studies in Europe over recent years. The methodology considers the impact on human health and well-being of GHG policies, which may be the result of changes in exposure patterns of the urban population to environmental contaminants such as ambient and indoor air pollution, as well as changes in housing, workplaces, transport, lifestyles and utilisation of urban green space. Specific and real city-level GHG policies have been evaluated for their health and wellbeing impact on the cities' populations. Keywords Climate Change mitigation; Policy; Urban; Health impact

Abstract Number	**S-1-19-02**
Presenter	Haikun Wang*, Miaomiao Liu, Jun Bi, Clive Sabel
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Co-benefits of climate change mitigation policies on health: a case study in Suzhou City, China

Background Economic expansion in China recentlyhas mainly relied on consumption of fossil fuel, which has led to dramatic increases in air pollutants and greenhouse gases emissions. China's cities are now facing the worst problems of air pollution and energy consumption in the world. Combined with high density of population in urban areas, urban residents are at significant and increasing health risk. Local city governments have already proposed various policies to reduce energy consumption and air pollution which may also produce co-benefits on public health. Aims The aim was to develop a methodology and apply it to assess co-benefit of climate change mitigation policies on health in a case city of Suzhou, China. Methods Air pollutant concentrations of Suzhou urban area were modelled using traffic and city scale dispersion models (OSPM/CALINE 4 and CMAQ) coupledwith monitored air quality data. Population density and resident time activity diary (TAD) data have been incorporated with air quality data to calculate the exposure of urban resident to PM10/PM2.5 in Suzhou city for the period 2006-2010. Health impacts have beencalculated using published exposure-response functions in China. Results GIS-based exposure assessment methods which can assess air pollution exposures at various scales have been designed for Chinese cities. They have been appliedto assess the health impact of air pollution in Suzhou urban area during the period 2006-2010. Conclusions Although the emissions of air pollutants and greenhouse gases have increased in Suzhou during the period 2006-2010, policies have slowed the exponential increase of these emissions and have avoided air quality deteriorating so quickly. Quantitative results of the effect of major climate change mitigation policies on air pollution and thus population health will be presented. We also recommend which of the climate change policy options are most successful to avoid adverse health impacts for Chinese

Abstract Number	**S-1-19-03**
Presenter	Menno Keuken*, Sander Jonkers, Sander Schaminée, Clive Sabel, Hongshuang Lau, Junhan Liu, Xiaochuan Pan, Laura Perez, Stephan Trüeb, Willem-Jan Okkerse
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Health effects of CO2 reduction measures by road traffic in Xi'an, Basel and Rotterdam

Background Urban road traffic is an important contributor to CO2 emissions from urban areas. Also, health effects have been associated with traffic-related emissions of particulate matter (PM) from exhaust emissions (elemental carbon: EC with organic compounds: OC), break and tire wear (heavy metals) and re-suspension of road dust. In European and Chinese cities, traffic measures are proposed to reduce CO2 emissions. The impact of these measures on CO2 emissions, as well as health effects and well-being is investigated in URGENCHE. Aims The aim is to present the approach and results of case studies in the cities of Xi'an, Basel and Rotterdam. Methods Long-term exposure to annual average air pollution (PM10 and EC) is modelled for the population in Xi'an, Basel and Rotterdam for 2010 and 2020 with and without CO2 reduction measures. The health impact assessment is computed from the relative risks on all-cause mortality to PM10 and EC. The impact on wellbeing is assessed by noise mapping which is limited to the city of Rotterdam. Results The results for the health burden in 2010 and the health impact of a CO2 reduction measures are compared to business-as-usual for 2020. Also, noise is presented for Rotterdam to illustrate the impact on wellbeing. Conclusions It is concluded that increased electric transport in Rotterdam and more public transport in Basel reduces emission of CO2, EC and noise which improves wellbeing and reduces health impact. In Xi'an it is difficult to assess the health benefits of traffic measures due to lack of data but based on "open source" data it is likely that other sources (coal fired energy production) are more important to reduce health impact of air pollution.

Abstract Number	**S-1-19-04**
Presenter	Laura Perez*, Stephan Trüeb, Martina S. Ragettli, Menno Keuken, Cosimo Todaro, Andrea von Känel, Franziska Schwager, Michael Redle, Clive Sabel, Nino Kuenzli
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure modeling

Proximity to traffic, health and wellbeing: comparing impacts and benefits of climate change-related policies in Basel.

Background The Citizens of Basel requested that road traffic should not grow by more than 10% between 2010 and 2020 in Basel, Switzerland. To reach this target, several policies aiming at reducing and channelling traffic through specific areas of the city are being considered together with other mobility measures. The health and well-being benefits (or impact) of the planned measures, especially with regards to near-road traffic pollution exposure, are unknown. Aim Health and well-being implications from different transport policies for the population in Basel, Switzerland are compared. We contribute to develop a framework for identifying win-win policies in the transport sector. Methods Changes in population exposure to near-road traffic pollution and urban pollution (elemental carbon, NO2), noise and physical activity through changes in walking and cycling patterns at horizon 2020 are estimated for several transport policies. Attributable health outcomes (mortality and disability-adjusted life years) and urban functionality, a proxy for well-being, associated to these changes are compared. Results While changes in population exposure in Basel are expected to be small independently of the transport and mobility measures adopted in the future, we identify the pathways by which the health benefits for the population could be the largest and the impact on urban functionality minimized. Conclusions Methods to integrate health and wellbeing in urban policy making, such as in the transport sector, are still developing. The effectiveness of green-house gas reduction policies should also be evaluated through the direct and indirect effects on health and well-being.

Abstract Number	**S-1-19-05**
Presenter	Sandra Torras Ortiz*, Tatjana Kampffmeyer, Rainer Friedrich
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	others

The health impact of wood as domestic space heating in the city of Stuttgart

Background Due to rising fossil fuel prices coupled with policy measures promoting biomass fuels, the number of installed pellet stoves has increased rapidly over the last decade years, so that at the end of 2013 will be over 300 000 installed pellet stoves in Germany. Although pellets stoves have lower emission than manually loaded single fireplaces or older wood boilers, they produce higher dust, CO and VOC emissions than modern oil and gas stoves due to incomplete combustion. Reliable data on pellets stove emissions would allow to assess the health impact related to this technology. Aims This work aims to provide reliable information to the dust emissions from pellet boilers for domestic space heating operating under realistic conditions and to assess the health impacts related to the pellet stoves emissions in the City of Stuttgart. Methods Particulate matter, CO and VOC emissions produced by pellet stoves in the City of Stuttgart for the year 2006 were estimated. Two scenarios were then defined for the year 2020: strong increase in newly installed pellets stoves; and a hypothetical legal ban of wood fuel in the inner city. Using the impact pathway approach, health impacts were estimated. Results The proportion of pellets in the energy supply in the Stuttgart region is very low compared to other sources. After wood stoves, pellet stoves were the second-largest source of emissions. The legal ban of wood fuel in the inner citywould reduce emissions from pellet combustion by 1% in the Stuttgart region and by 17% in the city of Stuttgart compared to the volume of emissions in a BAU scenario. The health impact followed the same trend. Conclusions The contribution of pellet stoves to the total emissions in the Stuttgart region is small. However, the proportion of the particulate matter emissions compared to gas or oil is higher by almost a factor of three. Fostering a wider dissemination of pellet stoves should favor the installation of modern combustion control equipment.

Abstract Number	**S-1-19-06**
Presenter	Dimosthenis Sarigiannis*, Periklis Kontoroupis, Nikolaki Spyridoula, Spyros Karakitsios
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

The impact of urban climate change policies on health under financial crisis conditions – the city of Thessaloniki

Background In Thessaloniki (Northern Greece), while in the past, air pollution was credited to traffic, nowadays domestic heating is more significant, due to the reduced traffic volumes and the shift to biomass use for domestic heating. The latter is the combined result of a climate change policy - allowing the use of biomass burning for heating in Thessaloniki- and a financial crisis consequence which is the increase of liquid fuels taxation. Aims An integrated methodological framework was developed, for assessing the combined effects of financial crisis and climate change policies. Methods Using series of indoor and outdoor measurements, coupled with a traffic dispersion model (OSPM), ambient air quality is assessed for years 2010, 2011 and 2012. Ambient air concentrations of major regulated pollutants (PM10, PM2.5, NO2, CO and benzene) are used as input to the state-of-the-art computational platform INTERA, for assessing overall population exposure. The later allows us to incorporate the combined effects of outdoor air penetration, the presence of indoor sources (e.g. fireplaces, stoves, smoking), the housing conditions (residences volumes, air exchange rate) and the respective time activity patterns of the exposed population. Health impact assessment (attributed mortality and morbidity) is carried out using well-established exposure-response functions. Results The traffic component was stronger the previous years, while a small increase in air pollution was observed during winter. On the contrary, in year 2012, traffic component is reduced and a significant increase of air pollution levels is observed during the winter, attributed to the miss-use of biomass burning (open fireplaces, unspecified fire-woods and pellets). As a result, during the wintertime, air pollution attributed mortality is increased up to 40%. Conclusions The miss-use of a climate change policy coupled to a financial crisis, might result to significant increase of the population health burden.

Abstract Number	**S-1-24-01**
Presenter	Mary Wolff*, Mary Schauer-Berigan, Matt Dahm, Mohana Roy, Andrea Rothenberg, Barbara Brenner, Elizabeth Whelan, Laura Hodson
Exposure	others
Health domains	other
Type of research	exposure measurement

Epidemiological research on engineered nanomaterials: knowledge and needs

Background: Documented nanoparticle exposures in humans occur in the workplace and within the external environment. The potential may exist for nanoparticle exposure, at a reduced rate, from a wide variety of consumer and medical products as well. While there is extensive research on health effects of ambient nanoparticulate exposure, research about toxicological properties, exposures and health effects of engineered nanomaterialsis limited. Aims: A framework to implement human research is being developed, and preliminary epidemiologic research is underway at NIOSH among workers exposed to carbon nanomaterials. Methods: We conducted a needs assessment to identify primary requirements for launching research, including exposure assessment methods development, and the determination of populations at risk, potential health outcomes, and latency. Results: Measuring exposure requires source identification and documentation of uptake via inhalation, dermal, and oral routes. Workers have a higher potential for exposure, mainly by inhalation, and consumers use personal products, foods, household products, clothing, and medications. Potential for carbon nanoparticle exposure in the workplace is being estimated by air sampling and dermal wipes, while consumer exposures may be identifiable via product-use records. Exposure biomarkers have not yet been developed, and systemic exposure may be difficult to measure. Toxicological findings have informed the use of preclinical biomarkers that can serve as intermediate endpoints in human studies (e.g. inflammatory markers or markers of genetic damage). Conclusions: Measurement tools must be developed to document the extent of exposures in field studies; ambient contamination should be characterized in occupational and non-occupational settings; worker exposure registries and consumer exposure registries can be established; preclinical biomarkers of health outcomes should be validated. These steps will enable design of epidemiology studies (cross-sectional, longitudinal, pooled) to characterize the prevalence of exposures and the potential for health effects.

Abstract Number	**S-1-24-02**
Presenter	David Green*
Exposure	ambient air pollution
Health domains	other
Type of research	exposure measurement

Measurements of environmental nanomaterial in London and the UK

Measurements of ambient concentrations of aerosols at a range of locations in the UK conform to the definition of nanomaterial. The measurements methods we have used to assess the number, number size distribution, surface area and chemical composition will be described as well as the availability of data within the UK and Europe and its application to exposure assessment for epidemiological studies. The results of recent measurements and peer reviewed studies will be used to evaluate the physical and chemical characteristics of the measured nanomaterial. Aspects of location (traffic, urban background and rural), sources and atmospheric processing will be addressed. The impact of changes on ambient concentrations due to fuel composition will be addressed by examining two studies. The first study describes changes to the long term trends in particle number concentrations in the UK due to the impact of “sulphur free” gasoline, the second one examines the change in concentrations of ambient cerium concentrations following the introduction of a engineered cerium oxide nanoparticles as fuel additives. The preliminary results of an exposure assessment study of children to traffic generated nanomaterial on walk to school routes will also be presented.

Abstract Number	**S-1-24-04**
Presenter	Srikanth Nadadur*, David Balshaw
Exposure	others
Health domains	other
Type of research	health impact assessment

Nanotechnology Environmental Health and Safety Research Efforts: The need for Multidisciplinary Consortia Approaches

The increased production and use of nanoscale materials and nano-enabled devices provides opportunities for intentional and accidental exposures to engineered nanomaterials (ENMs) with unknown health consequences. The initial conventional toxicology approaches to understand toxicity of ENMs indicated novel nanoscale interactions. This led to a clear recognition that gaining a fundamental knowledge of the specific physical or chemical properties of ENMs that dictate interaction with biological systems is critical. With subtle modifications such as surface coating or size, one can generate thousands of variants of ENMs with diverse physical and chemical properties. These issues can be addressed by scientific programs that are coordinated and integrated efforts across multiple laboratories. Towards this, the NIEHS has initiated consortia-based research models to encourage multidisciplinary teams of investigators work together towards a common goal. The consortium will integrate ENM-biological interactions from in vitro and in vivo studies to develop computational predictive modeling to elucidate biological response. Additional efforts include developing harmonized protocols and methods for generating reliable and reproducible data across multiple laboratories using relevant in vitro and in vivo model systems, systems biology approaches and toxicokinetics modeling. Results generated across these common efforts will feed into predictive models for assessing health effects associated with ENMs physical and chemical properties. The consortium research model supported by NIEHS serves as a framework to guide the scientific regulatory decision making processes. Furthermore, it can be used as a tool to guide development of a new generation of ENMs. This presentation will cover the scientific goals behind establishing a research consortium, address the impact of our initial research efforts, and the lessons learned in this process, as well as critical research gaps and research needs to support the national strategy for Nano Environmental Health and Safety in the US.

Abstract Number	**S-1-24-05**
Presenter	Donatello Telesca*
Exposure	others
Health domains	other
Type of research	exposure modeling

Quantitative Structure Activity Relationship Modeling to predict biological effects of ENMs

A fundamental goal in nano-toxicology is that of identifying particle physical and chemical properties, which are likely to explain biological hazard. The first line of screening for potentially adverse outcomes often consists of exposure escalation experiments, involving the exposure of microorganisms or cell lines to a library of nanomaterials. We discuss several Statistical issues associated with analyses aiming at assessing the relationship between physicochemical predictors and exposure escalation data. Our analytical proposal is based on the integration of Bayesian trees for modeling threshold effects and interactions, and penalized B-splines for dose and time-response surfaces smoothing. The target posterior distribution for inference is explored via a Markov Chain Monte Carlo algorithm. We illustrate the application of our method to the analysis of a library of 24 nano metal oxides.

Abstract Number	**S-1-29-01**
Presenter	Lillian Sie, Chia-Jui Chuang, Hsiao-Yen Chen, Chien-Wen Sun, Tsung-Ho Ying, Shu-Li Wang*
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

Effects of phthalate exposure on sex hormones among 2, 5, 8 and 11 year old children in Central Taiwan

Background: Phthalate esters are widely used chemicals found in plastics and other commercial products. Despite evidence of anti-androgenic effects from this chemical, few studies have examined the effects of phthalate exposure on children's sex hormones. We investigated the association between the exposure and sex hormone levels in children from central Taiwan using data from a prospective birth cohort study. Methods: Around 170 children were followed at 0, 2-3, 5-6, 8-9 and 11-12 years of age. Estradiol, testosterone, free testosterone, follicle-stimulating hormone (FSH), progesterone and sex hormone-binding globulin (SHBG) were measured in cord and venous blood. The phthalate metabolites MEHP, 5OH-MEHP, 5oxo-MEHP, MEP, MMP, MnBP, MBzP were measured in urine with LC-MS/MS methods. Simple linear regression stratified by age and gender was conducted to test for the association of phthalate exposure with sex hormone levels in children. Results: Decreased levels of testosterone and estradiol from phthalate exposure are consistent across age groups and both genders. For example, MEHP (β= -0.201, p <.0001) was inversely associated with estradiol levels in 5 year olds, particularly girls (β= -0.239, p<.0001). The inverse association of several phthalates with estradiol was also apparent among infant girls who were prenatally exposed. Since testosterone levels were transformed to 1/√Testosterone for the regressions, having a positive coefficient is evidence of a negative association. For 2 year old children, MEP (β=0.019, p=0.03) was inversely associated with testosterone levels. Decreased testosterone was also associated with MBzP (β=0.019, p=0.046) in this age group, and this association was even more evident in boys. The patterns were similar for the 5 and 11 year old groups. Conclusion: Results showed that phthalate exposure is associated with decreased levels of testosterone and estradiol. This is one of the few longitudinal studies conducted on this topic.

Abstract Number	**S-1-29-02**
Presenter	Virissa Lenters*, Lützen Portengen, Lidwien A.M. Smit, Bo A.G. Jönsson, Aleksander Giwercman, Lars Rylander, Aldert H Piersma, Gunnar Toft, Jens Peter Bonde, Dick Heederik, Roel Vermeulen
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

Global Screening of Environmental Contaminants and Reproductive Function in Greenlandic and European Men Using Partial Least Squares Regression

Background: Numerous environmental contaminants have been suggested to adversely affect reproductive health. However, the complex correlation structure of contaminants and multiple testing issues limit interpretation of existing evidence. Aims: We evaluated exposure-response relationships (ERRs) for a large set of biomarkers of exposure and biomarkers of male reproductive health using a multivariate partial least squares (PLS) regression approach to account for correlation among exposures and multiple testing. Methods: Male partners of pregnant women were recruited from 2002 to 2004 during routine antenatal care visits from 3 locations: Greenland; Warsaw, Poland; and Kharkiv, Ukraine (n=602). Fifteen contaminants were measured in blood, including metabolites of diethylhexyl and diisononyl phthalates, perfluorinated compounds, 3 metals and 3 organochlorines. Over 20 biomarkers of reproductive function were assessed, including serum levels of reproductive hormones, markers of semen quality, sperm chromatin integrity, epididymal and accessory sex gland function, and X:Y chromosome ratio. We tested ERRs using PLS regression and applied a permutation procedure to derive a suitable significance threshold. Results: Of the 330 ERRs examined in 22 PLS regression models, we detected 6 significant ERRs. The most robust associations were a negative association between phthalates and testosterone, and a positive association between cadmium and testosterone. Conclusions: The extended-PLS regression appropriately accounted for correlated exposures and multiple testing. Results provide further epidemiologic support for a negative effect of phthalates on male reproductive function.

Abstract Number	**S-1-29-03**
Presenter	John D. Meeker, Kelly K. Ferguson, Alejandra Cantoral Preciado, Karen E. Peterson*, Martha Maria Tellez-Rojo Solis
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	cohort study

In Utero and Childhood Phthalate Exposure in Relation to Sexual Maturation in Boys

There is great concern regarding the potential adverse developmental effects from the documented widespread exposure to known or suspected endocrine disrupting compounds (EDCs) among pregnant women and children. Human studies of the impacts of EDC exposures on sexual maturation are extremely limited. Precocious or delayed puberty may both have significant health, social, and psychological impacts on adolescents that can persist into adulthood. Phthalates are among the EDCs of greatest concern due to their demonstrated effects on endocrine function and male reproductive development in both animals and humans. In this study, we explored the relationship between in utero or childhood exposure to phthalates and sexual maturation among 114 boys within an ongoing longitudinal birth cohort study being conducted in Mexico City. Tanner stage was assessed by a clinician when the boys were between the ages of 8 and 13, and a hormone panel was measured in serum samples collected at the clinic visit. We measured urinary phthalate metabolites in maternal 3rd trimester urine samples when the boys were in utero, as well as in urine samples collected from the boys at the time of their clinical assessment. Adjusting for age, BMI and urinary specific gravity, boys whose mothers had higher concentrations of urinary DEHP metabolites, MBzP, and MBP in the 3rd trimester of pregnancy had reduced odds of pubic hair development beyond Tanner stage 1. These results were consistent with observed associations between certain phthalates and decreased DHEAS and/or increased SHBG. No relationships between phthalates in urine from childhood and Tanner staging were found, though there were positive associations between DEHP metabolites in the children's urine and SHBG. In conclusion, we found suggestive evidence for impacts of early-life exposure to phthalates on sexual maturation. We plan to expand our work to a larger number of children with additional longitudinal follow-up during adolescence.

Abstract Number	**S-1-29-04**
Presenter	Morten Søndergaard Jensen, Bent Nørgaard-Pedersen, Bo A.G. Jönsson, Jens Peter Bonde, David M. Hougaard, Arieh Cohen, Christian H. Lindh, Richard Ivell, Ravinder Anand-Ivell, Ane Marie Thulstrup, Gunnar Toft*
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	case-control study

Prenatal phthalate exposure is associated with human fetal Leydig cell function but not with cryptorchidism and hypospadias

Background: Studies on rats indicate that prenatal exposure to certain phthalates may cause reproductive tract disorders by reducing fetal insulin like factor 3 (INSL3) and testosterone production. However, recent studies on human fetal testis explants have been unable to corroborate this mechanism in humans. Aims: We evaluated the effect of phthalate exposure on the occurrence of cryptorchidism and hypospadias and on fetal Leydig cell hormone production in humans, using a nested case–control design. Methods: We measured metabolites of di(2-ethylhexyl) phthalate (DEHP) and diisononyl phthalate (DiNP) in a total of 645 second trimester amniotic fluid samples from mothers of 270 boys with cryptorchidism, 75 boys with hypospadias and 300 randomly selected controls. Samples were from a large Danish biobank. Due to volume restraints INSL3 and steroid hormones were assessed in 475 and 545 of the samples respectively. Results: We observed no association between amniotic fluid phthalate metabolite concentrations and risk of cryptorchidism or hypospadias. However, we did observe a highly significant negative association between the amniotic fluid DEHP metabolite and INSL3 ($p<0.001$). On the other hand, testosterone and other steroid hormones were positively associated to DEHP metabolite concentration, and this association appeared to be stronger in cases of cryptorchidism and hypospadias than in controls. DINP metabolite concentration was not consistently associated with fetal Leydig cell function. Conclusions: Fetal Leydig cell hormone production may be affected by exposure to DEHP during pregnancy. However, our results indicated that the possible endocrine disturbances by fetal DEHP exposure did not lead to malformation of the male genital organs. Whether the observed potential endocrine disturbances in fetal life have other long–term consequences for male reproductive health can not be evaluated by the present study.

Abstract Number	**S-1-29-05**
Presenter	Aldert H Piersma*
Exposure	biomarker
Health domains	reproductive outcomes
Type of research	review

Review of recent experimental evidence: phthalates and male reproductive endpoints

The antiandrogenic properties of phthalates and their characterization as testicular developmental toxicants have been derived from a series of experimental studies in the rat. Effects of developmental exposure in the rat include decreased anogenital distance, hypospermatogenesis, underdeveloped reproductive organs, cryptorchidism and hypospadias, and formation of multinucleated germ cells (MNG) in the testis. The underlying mechanism is related to the suppression of testosterone production in Leydig cells in the rat testis. The mouse, however, did not show suppression of steriodogenesis and reproductive organ malformations, but did show MNG formation. Also in marmosets, phthalates did not affect reproductive organ development, nor did testicular histopathology reveal abnormalities. The human testicular developmental response to phthalates has been difficult to address experimentally for ethical reasons and due to the absence of appropriate alternative models. Two independent recent studies have used xenotransplants of human fetal testis in immunologically compromised rodents to study the effects of phthalate exposure in man. Both studies found no effects on steroidogenesis whereas MNG were induced in both models in human fetal testis implants, confirming adequate internal exposure of implanted target tissue. Moreover, in the same model, steroidogenesis in mouse implants was unaffected as well, although MNG were observed. Rat implants showed suppression of steroidogenesis as well as MNG formation, confirming the general sensitivity of the model as in the in vivo situation. These results strongly suggest that human fetal testicular tissue is not sensitive to the endocrine disrupting effects of phthalates.

Abstract Number	**S-1-30-01**
Presenter	Kathryn Cottingham*, Tracy Punshon, Courtney Carignan, Vicki Sayarath, Brian Jackson, Vivien Taylor, Diane Gilbert-Diamond, Susan A. Korrick, Margaret Karagas
Exposure	arsenic
Health domains	other
Type of research	cohort study

Estimating early life exposure to arsenic via food and water

Background. Childhood exposure to high concentrations of arsenic (As) in drinking water has been associated with decrements in verbal, memory, and motor skills and overall cognitive function. Much less is known about the possible effects of low-level As exposure, especially during childhood, which in most regions of the US and Europe is likely to occur primarily through food, especially rice. Aims. This study sought to estimate the potential exposure to As via water and food in a population of U.S. infants who experience a gradient of exposure via their household water source. Methods. After measuring total As and As speciation in powdered formulas and key weaning foods, we estimated As intake in the prospective New Hampshire Birth Cohort (NHBC) using measured water As and As content in food, telephone surveys of infant feeding patterns, and 3-day food diaries. Our preliminary analyses are based on survey data at 4, 8 and 12 months on ~100 children. Results. Weaning foods and formulas containing rice or rice products generally had higher As concentrations – both total As and inorganic As – than foods that did not contain rice. To date, nearly 9 in 10 families have fed their children rice cereal during weaning. At 12 months, over 15% of families still used rice cereal and in over 10% it was used daily – a consumption rate that translates to an estimated 1-7 µg As/d. Additionally, in our initial study group, more than 10% of families were using water that was above the current WHO maximum contaminant level (10 µg/L) to make infant formula. Conclusions. Rice cereal was commonly fed to children in our cohort during weaning, and thus could be a primary source of As exposure, especially for children who have relatively low As concentrations in their drinking water. In addition to water, this finding supports the expectation that children may be exposed to appreciable amounts of As via food.

Abstract Number	**S-1-30-02**
Presenter	Andrew Meharg*
Exposure	arsenic
Health domains	other
Type of research	others

Human exposure to inorganic arsenic through agronomic food chains

Background: Arsenic is a class one non-threshold carcinogen whose main exposure to humans is dietary. Aims: To illustrate that rice grain is the dominant form of human exposure to inorganic arsenic, particularly the importance of arsenic speciation in arsenic assimilation by rice, dietary exposure and human metabolism. Methods: Inductively coupled plasma – mass spectrometry (ICP-MS), coupled with ion exchange chromatography, was used to characterize arsenic speciation in paddy soils, rice grain from a wide range of sources, rice products intended for human consumption and in urine from humans with known dietary exposure to rice. In this way arsenic in the human food-chain can be followed from soil to human excretion. Using this data it will be illustrated how different populations and sub-populations (based on special diets, structured by age or structured by ethnicity, etc.) leads to differing inorganic, and total organic, exposure patterns. The findings will be discussed in context of the cancer risk that arsenic in rice poses to humans. Conclusions: Inorganic arsenic exposure varies greatly depending on the geographical origin of rice, food processing and dietary consumption patterns. Cancer risks for the highest exposed populations are calculated to be in the order of 20 in 10,000 lifetime excess cancers for populations that consume 500 g of rice per day, the typical quantity ingested in the rice based diets of the poorest economies in SE Asia. Data also suggests that particular attention should be given to baby and toddler exposure to rice, as they have a high rice component to their diet, and high food consumption rates when expressed on a body weight basis.

Abstract Number	**S-1-30-03**
Presenter	Angelika Tritscher*
Exposure	arsenic
Health domains	policy
Type of research	others

International risk assessment on arsenic and management measures for rice

Background Arsenic is found in the environment from natural occurrence and from anthropogenic activity. Main human non-occupational exposure is via food and drinking water, exposures vary significantly in different regions and within regions, primarily due to arsenic levels in groundwater sources for drinking-water. From epidemiological drinking-water studies, inorganic arsenic has been identified as a human carcinogen. To take account of most recent toxicological and epidemiological data the Joint FAO/WHO Expert Committee on Food Additives (JECFA) re-evaluated in 2010 the human health risk of arsenic to provide scientific evidence for regulatory measures to limit oral arsenic exposure. Conclusions The approach to quantitative assessment of cancer risk from inorganic arsenic is limited mainly by the lack of information on total exposure in the epidemiological studies. From dose-response analysis the inorganic arsenic benchmark dose 95% lower confidence limit (BMDL) for a 0.5% increased incidence of lung cancer was determined by using a range of assumptions to estimate exposure from drinking-water and food. The BMDL0.5 was computed to be 3.0 µg/kg body weight per day (2.0–7.0 µg/kg bw/d). Because the previously established provisional tolerable weekly intake (PTWI) of 15 µg/kg bw (2.1 µg/kg bw/d) was in the region of the BMDL0.5 it was considered not to be health protective and was withdrawn. Reported mean dietary exposure to inorganic arsenic in the USA and various European and Asian countries ranged from 0.1 to 3.0 µg/kg bw/d. Drinking-water was a major contributor to total inorganic arsenic exposures and can also be an important source of arsenic in food through food preparation and irrigation of crops, particularly rice. Since rice can be major source of arsenic exposure the Codex Committee on Contaminants in Food is developing a code of practice for the prevention and reduction of arsenic contamination in rice. Outcome of recent discussions will be presented.

Abstract Number	**S-1-30-04**
Presenter	Habibul Ahsan*
Exposure	arsenic
Health domains	cancer
Type of research	cohort study

Urinary and dietary analysis of 18,470 Bangladeshis reveal a correlation of rice consumption with arsenic exposure and toxicity

Background: Recent data suggest that rice consumption may be a source of arsenic exposure. Objective: We utilized data from the Health Effects of Arsenic Longitudinal Study (HEALS) in Araihazar, Bangladesh, to evaluate the association of steamed rice consumption with urinary total arsenic concentration and classical arsenical skin lesions in the overall study cohort (N=18,470) and in a subset of the cohort with urinary arsenic metabolite data available (N=4,517). Methods: General linear models with standardized beta coefficients were used to estimate the associations between steamed rice consumption and urinary total arsenic concentration and urinary arsenic metabolites. Logistic regression models were used to estimate prevalence odds ratios and their 95% CIs for the associations between rice intake and prevalent skin lesions at baseline. Discrete time hazard models were used to estimate discrete time hazard ratios and their 95% CIs for the associations between rice intake and incident skin lesions. Results: We observed positive associations between consumption of steamed rice and creatinine-adjusted urinary total arsenic (β=0.041, 95% CI: 0.032-0.051) and urinary total arsenic with statistical adjustment for creatinine in the model (β=0.043, 95% CI: 0.032-0.053). Additionally, we observed a significant trend in skin lesion prevalence (p-trend=0.007) and a moderate trend in skin lesion incidence (p-trend=0.07) associated with increased intake of steamed rice, especially among individuals with low exposure to arsenic from drinking water. Conclusions: This large population-based study suggests that rice intake is a source of arsenic exposure. Better regulation of arsenic exposure in humans from sources beyond drinking water is needed.

Abstract Number	**S-1-32-01**
Presenter	Steven Hirschfeld*
Exposure	others
Health domains	policy
Type of research	cohort study

Harmonization in the National Children's Study

The National Children’s Study (NCS), congressionally mandated by Children’s Health Act of 2000, is the largest long term study of children’s health and development ever to be conducted in the U.S. It is a longitudinal study of children, their families, and their environment being conducted as an integrated system of activities to examine the relationships between environmental exposures and genetics on growth, development and health of children. Environment is broadly defined to include factors such as air, water, soil, dust, noise, diet, social and cultural setting, access to health care, socio-economic status and learning. The scope and complexity of the study necessitates a planning process that is systematic, dynamic, flexible, and evidence based. In the NCS system, harmonization extends beyond standardization of sampling and analysis methods to include procedures for recruitment and retention; specimen collection, storage, and analysis; information management system architecture and data management; and harmonization of terminology for stages and benchmarks of child growth and development. This approach enables the study to serve as a high quality flexible data acquisition platform to address multiple hypotheses and analyses that can be augmented with supplemental methodological studies and adjunct studies to expand opportunities for additional data collection and to share data broadly with other researchers in an interoperable manner. Collectively these activities form the basis for establishing a learning community with structured and systematic training, feedback, process maps, process improvement, modeling, and simulations to advance understanding about children’s health.

Abstract Number	**S-1-32-02**
Presenter	Marie-Aline Charles*, Cecile Zaros, Michael Dellarco
Exposure	others
Health domains	policy
Type of research	cohort study

Harmonization of Exposure Assessment Questionnaires in the Environment and Child Health International Birth Cohort Group

Background and aim: Harmonization of questionnaires to assess environmental exposures is among the objectives of the Environment and Child Health International Birth Cohort Group. Questionnaires are more difficult to harmonize than biological or environmental sampling because of language and cultural specificities. They are however important tools to assess the route of expositions. Methods: The first step of the work has been to gather questionnaires from all the birth cohorts on specific chosen exposures and to translate them into English. The second step will be to produce descriptive statistics from data of pilot or ongoing phases of the different cohorts. The third step will be to analyze the questions in relation to biological or environmental measurements in the different countries (not yet available) and to produce recommendations to select the more pertinent questions. Results: The first step highlighted the great diversity of questions provided by the experts from each country and the absence of validated reference questionnaires at the national as well as at the international level. Descriptive statistics for the assessment of domestic use of pesticides in the US, Japanese, and Chinese birth cohorts will be shown and discussed as an example. Conclusion: Environmental epidemiology is a recent field compared to other domains and there is a need for standardization of questionnaires. The work of the Environment and Child Health International Birth Cohort Group is a step forward to allow selection of questions pertinent for a given exposure. Test retest reliability and back translation into different languages will also be an important issue to tackle.

Abstract Number	**S-1-32-03**
Presenter	Marike Kolossa-Gehring*
Exposure	others
Health domains	policy
Type of research	cohort study

Integrating Experience from Cross-sectional Studies and Biobanking in the Development of the Research Program for a Large-Scale Birth Cohort

The Health Research Framework Program of the German Federal Government identifies birth cohorts as the instrument of choice to elucidate relations between exposure to environmental chemicals, well-being of infants and children,and health in later life. Their results are of high importance for the improvement of public health. The respective exposure assessment must cover a broad range of chemical, biological, physical, and psychosocial factors, as well as genetics. This requires an elaborate design for the selection of research questions, methods employed and sample consumption – and restriction to questions that can only be answered by a birth cohort. Decisions on biomarkers, environmental measurements, health outcomes, measures of socioeconomic status, and procedures for cryopreservation and storage of samples can be based on experiences from other epidemiological studies. This presentation will give an overview of the German experience concerning exposure assessment and the investigation of consumer habits correlation to health complaints. Identification of sources is not directly linked to the exposure-effects relation and thus does not need to be of highest priority in a birth cohort study, even though it supplies useful information about how to improve public health. Exposure assessment and its harmonization are apt to evolve in a broad variety of epidemiological studies out of the benefits of the harmonization activity of the international collaborative effort on birth cohort studies.

Abstract Number	**S-1-32-04**
Presenter	Ruth Etzel*
Exposure	biomarker
Health domains	neurodevelopment
Type of research	cohort study

Introduction to the Environment and Child Health International Birth Cohort Group: Overview, brief history and highlights of progress

Large scale birth cohort studies of environmental influences on children's health and development are currently being planned or conducted in many places, including France, Germany, Japan, Shanghai (China), and the United States. The major objective of these “next generation” birth cohort studies is to better understand a broad range of environmental factors that influence the health and well-being of infants and children. These large scale studies intend to enrol tens of thousands of pregnant women, but many outcomes of interest are relatively rare, and even studies of 100,000 infants may not be adequately powered to evaluate the relationship between such rare outcomes and environmental risk factors. An International Group composed of study teams from France, Germany, Japan, Shanghai (China), and the United States has been meeting for the past 2 years to work towards harmonization of selected variables, which would enable the studies to conduct combined analyses in the future. Harmonization of certain infant health outcomes, biomarkers, environmental measurements, and measures of socioeconomic and migration status has been initiated. This presentation will give an overview of the group and its history, describe progress in the effort to harmonize biomarkers and discuss the advantages of this international collaborative effort.

Abstract Number	**S-1-32-05**
Presenter	Tian Ying*, Xiaodan Yu, Jun Jim Zhang
Exposure	others
Health domains	policy
Type of research	cohort study

Introduction to the Shanghai Birth Cohort

With rapid economic development in China, environmental pollution has become a major concern in many parts of the country. Government statistics indicate that the incidence of birth defects has been increasing in recent years. Meanwhile, thanks to the “one child family policy”, child health is often the central focus of the whole family. These joint concerns have driven children’s environmental health to the forefront among various social issues. The Shanghai Birth Cohort (SBC) is currently in a pilot phase, aiming to recruit 3,000 women who come to maternity and child hospitals in Shanghai for preconceptional care or first prenatal care in the first trimester of gestation. Women will be followed up to 15 months before pregnancy with bimonthly telephone interviews. During pregnancy at each trimester, a follow-up visit will be scheduled. A wide range of information from socioeconomic status to psychological and nutritional factors will be collected. Blood and urine samples will be collected at each visit. In addition to hospital visits, 30% of the women will have a home visit for collection of detailed environmental and nutritional information, and home environmental sampling. At birth, cord blood and placental tissue samples will be collected. The children will be followed at 42 days postpartum, and 6, 12 and 24 months. Diet, habit and disease information will be recorded and growth will be measured. A child neurobehavioral assessment will be made. The purpose of this study is to examine the effects of genetic, environmental and behavioral factors on female reproductive health, pregnancy outcomes, child growth and development, and risks of childhood diseases. Findings from this study will provide essential support for evidence-based public health policymaking to improve environment, maternal and child health.

Abstract Number	**S-1-32-06**
Presenter	Shoji Nakayama*, Eisaku Toda, Hiroshi Nitta, Toshihiro Kawamoto
Exposure	others
Health domains	policy
Type of research	cohort study

Japan Environment and Children's Study

The Japan Environment and Children's Study (JECS) started in January 2011 aiming to enroll 100,000 participants in Japan within 3 years. The participating children will be followed up until they reach 13 years of age. The study is conducted by the Ministry of the Environment and the National Institute for Environmental Studies and other stakeholders, including 15 regional centres (in locations of the study nationwide). The study will investigate the impact of environmental factors on children's health and development. The environmental factors include chemical/physical exposures, genetics, socio-economics and lifestyle. Emphasis will be given to environmental chemicals such as persistent organic pollutants (POPs): dioxins, PCBs, organofluorine compounds, flame retardants, etc.), heavy metals (mercury, lead, arsenic, cadmium, etc.), endocrine disruptors (bisphenol A, etc.), agrichemicals and volatile organic compounds (benzene, etc.). As of 14 March 2013 the study had enrolled 63,000 pregnant women with a consent rate of 76%. Over 40,000 babies had been born to study participants as of 14 March 2013. Biospecimens including maternal and paternal blood, cord blood, maternal and child hair and dried blood spots from children are collected during pregnancy and after birth. A portion of the samples are tested for clinical biochemistry and the rest are stored for chemical and genetic analyses. JECS has started analysing some of the collected biospecimens for heavy metals. A variety of environmental measurement procedures have been tested for feasibility, practicability and cost-effectiveness. The current status of the JECS and the preliminary analytical results will be presented.

Abstract Number	**S-1-33-01**
Presenter	Ana Navas-Acien*
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Secondhand smoke exposure in Latin America: measuring air nicotine to advance smoke-free environments

Background: Secondhand tobacco smoke (SHS) remains a major global health problem. In Latin America, Objective SHS monitoring conducted in the last 10 years has contributed to document levels of SHS exposure, supporting the enactment of smoke-free legislation in several countries, evaluating the level of compliance with the legislation, and comparing the results with studies from other regions. Aims: To discuss the use of air nicotine monitoring in public places to advance smoke-free environments in Latin America. Methods: Between 2002-2005 we measured air nicotine concentrations in public places from 11 countries in Latin America (Argentina, Brazil, Chile, Costa Rica, Honduras, Guatemala, Mexico, Panama, Paraguay, Peru, Uruguay) using a standardized protocol. The following public places were evaluated: schools, hospitals, government buildings, airports, restaurants and bars. The same protocol was again implemented in Uruguay and Guatemala after the passing of smoke-free legislations and in Chile after the passing of a partial smoking ban legislation. Results: SHS exposure was widespread in Latin America at the beginning of the 21st century, including hospitals and government buildings. Air nicotine concentrations were highest in restaurant and bars. In Uruguay and Guatemala, air nicotine concentrations were markedly decreased after the implementation of smoke-free legislation, although there was room for additional enforcement in some venues. In Chile, air nicotine concentrations remained practically unchanged after the enactment of a partial legislation except in venues with voluntary smoke-free policies. Conclusion: Similar to other regions of the world, Objective SHS monitoring was a useful tool in support of and in the evaluation of smoke-free legislations in Latin-America. Additional efforts are needed to protect the population from SHS exposure in public and private places.

Abstract Number	**S-1-33-02**
Presenter	Muhammad Masood Kadir*, Sarah Saleem, Omrana Pasha
Exposure	household air pollution
Health domains	no health domain
Type of research	cross-sectional study

Biomass fuel and second hand smoke exposure among pregnant women from low and middle income countries

Background: Indoor air pollution is a major risk factor, accounting for 4 percent of the global burden of disease, equivalent to tobacco. Women and young children of developing countries are at greatest risk. Aims: To evaluate the extent of indoor air pollution exposures in pregnant women at ten sites in nine low and middle income countries (LMICs). Methods: We conducted a multi-country, cross-sectional survey. A clinic-based sample of 7,961 pregnant women was enrolled in Argentina, Brazil, Ecuador, Guatemala, Uruguay, Democratic Republic of Congo, Zambia, India and Pakistan. Data were collected by trained interviewers using a pre-tested questionnaire that included socio-economic and demographic variables, fuel used for cooking and heating, location of the kitchen, open flame or stove use, the pregnant woman's smoking of tobacco products and individual and household second-hand tobacco smoke exposure. Results: Pregnant women from India and Pakistan commonly reported use of wood (49.1–89.7%), crop residue and animal dung as cooking and heating fuel. They also commonly reported cooking on an open flame inside the homes using solid fuel. Pregnant women from Africa reported higher use of charcoal (85.4–93.5%). On the other hand Latin American pregnant women had greater use of petroleum gas. There was a significant association between solid fuel use and allowing smoking within the home at the Asian sites and in Zambia ($p < 0.05$). Conclusions: We found a very high use of solid fuels for heating and cooking from a number of sites in LMICs and the additional large contribution to poor quality indoor air in those sites by high exposure to second- hand tobacco smoke. These findings call for more research about the combined effect of these indoor air pollution exposures on maternal and child health outcomes.

Abstract Number	**S-1-33-03**
Presenter	Marisa Estarlich*, Carmen Iñiguez, Ana Esplugues, Gerard Hoek, Ferran Ballester
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

Comparison of different geo-statistical methods to estimate exposure to air pollution in epidemiological studies

Background: Scientific evidence indicates that chronic exposure to air pollution causes harm to health. A key issue to study the health impact of air pollution is to have reliable exposure assessment. Aims: To describe and to compare the methodology used to assign levels of residential outdoor exposure to nitrogen dioxide (NO2) in children from the INMA-Valencia cohort, Spain. Methods: Outdoor concentrations of NO2 were measured in the study area. Passive samplers were placed at 97 selected sitesduring periods of 7 days in three campaigns in 2009. A Geographic Information System (GIS) was established based on land use, road traffic (traffic intensity and distances), altitude, and population density. Diverse approaches combining land use regression (LUR) models and universal kriging were used to predict air pollution levels in the study area by using the mean of the campaigns. The assayed models took into account the following methods: a) kriging vs LUR (kriging only, LUR, and a combination of LUR plus kriging) and b) frequentist vs bayesian approaches. The different methodologies were evaluated by cross validation (leave-one-out method), by the root mean square errors (RMSE) and by the R-squared of the regression between measured and estimated concentrations Results: The mean NO2 measured value was 35.97, 24.64, and 19.60 µg/m3 in February, April, and July campaigns, respectively .The models presented a high goodness of fit (R2 around 0.8 and RMSE 20%) and the results were similar in all methods (LUR vs Kriging and frequentist vs bayesian methods) Conclusion/Discussion: Results show the usefulness offered by GIS for spatial pattern identification of outdoor air pollution levels in our study area. Following these findings we derive that estimations of air pollution levels using GIS can be a good proxy of actual measurements of outdoor air pollution levels. Exposure aassessment to air pollution during early age will allow analyzing its effects on health

Abstract Number	**S-1-33-04**
Presenter	Rémy Slama*, Marion Ouidir, Johanna LEPEULE, Lise Giorgis-Allemand, Sarah Lyon-Caen, Xavier Morelli, Valérie Siroux
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure modeling

How to assess exposure to atmospheric pollutants in epidemiological studies? An illustration of some trade-offs in the context of pregnancy exposures

Background: The concerns regarding possible effects of maternal exposure to atmospheric pollutants on pregnancy outcomes warrant effort in exposure assessment. Aims: We review and discuss the advantages and limitations of the various tools considered in epidemiology to assess air pollution exposure during pregnancy, focusing on outdoor models and tools for personalised exposure assessment. Methods and results: Models based on air quality monitoring station (AQMS) networks have a poor spatial resolution. Land-use regression (LUR) models have an improved spatial resolution but classically provide a yearly exposure estimate. We have suggested to combine LUR models with AQMS data to increase their temporal resolution. As shown in the context of Eden mother-child cohort, these seasonally-adjusted LUR models are in good agreement with dispersion models to predict pregnancy average exposure to pollutants such as NO2. The main limitations of such approaches are that 1) space-time activity and 2) indoor exposures are not taken into account. In a newly set mother-child cohort, SEPAGES-feasibility, women carried GPS and personal NO2 dosimeters and indoor measures have been conducted. We provide estimates of the amount of exposure misclassification attributable to these two sources of error, compared to approaches based solely on outdoors model-based estimates at the home address. Discussion: The progress in the assessment of exposure of pregnant women to atmospheric pollutants in the last decades have allowed refining exposure estimates and integrating time-, space- and behaviour-related exposure contrasts, at the cost of increase in logistic and budget constraints. These approaches may be cumbersome to implement on a large scale (to study rare outcomes); for such outcomes, detailed assessment of exposure using personal tools in a sub-population, combined to measurement error models to translate results in the larger population may be a good compromise.

Abstract Number	**S-1-33-05**
Presenter	Laura Perez*, Christophe Declercq, Carmen Iñiguez, Sylvia Medina, Nino Kuenzli
Exposure	others
Health domains	other
Type of research	others

Chronic burden of near-roadway traffic pollution in 10 European cities

BackgroundRecent epidemiological research suggests that near road traffic-related pollution may cause chronic disease, as well as exacerbate related pathologies, implying that the entire ‘chronic disease burden’ should be attributed to air pollution, no matter what the proximate causes of exacerbations were. AimsFor childhood asthma, coronary heart disease (CHD), and chronic obstructive pulmonary disease (COPD) in adults, we present a conceptual model to integrate the ‘chronic disease progression’ due to air pollution into the risk assessment. We discuss the implications for public health using results from 10 European cities (APHEKOM project). MethodsWe review the literature including the latest findings from the study on the long-term effects of air pollution in Europe (ESCAPE project) to feed into the chronic disease models. We estimate the burden of childhood asthma attributable to air pollution in 10 European cities by calculating the number of cases of 1) asthma caused by near road traffic-related pollution, and 2) acute asthma events related to urban air pollution levels. We repeat the approach for CHD and COPD in adults. We discuss limitations of the approach and data and research gaps. ResultsExposure to roads with high vehicle traffic, a proxy for near road traffic-related pollution, in European cities is large. Despite uncertainty and limitations, our results indicate that near-road traffic related pollution may be responsible for a large but preventable burden of chronic diseases and related acute morbidities in urban areas. ConclusionsTo better understand the health impacts of near road traffic-related pollution for urban populations, it is important to move beyond traditional burden assessments largely dominated by mortality and that only use population exposure averaged over large urban areas that miss the relevant

Abstract Number	**S-1-38-01**
Presenter	Vijendra Ingole, Joacim Rocklov, Sanjay Juvekar, Barbara Schumann*
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Association of meteorological conditions and cause-specific mortality assessed using verbal autopsy in Vadu HDSS, India

Background: Many diseases could be related weather changes. Limited studies have, however, ascertained the relationship between cause specific mortality and weather conditions in low and middle income countries. Aims: Current study aimed to estimate association of daily temperature, rainfall with all-cause mortality and mortality by communicable diseases, non-communicable diseases, and external causes of deaths in Vadu Health and Demographic Surveillance System (Vadu HDSS) area in western India. Methods: We used generalized linear logistics regression models to examine association of daily total and cause specific deaths with temperature and rainfall over the period January 2003-May 2010. Cause of deaths was determined using a standardized verbal autopsy tool. Delays between onset or change of weather conditions on mortality were estimated through three lag strata allowing delays up to 13 days. Relative risks (RR) with 95% confidence intervals (CI) were calculated. Results: Rainfall in the lag strata 7-13 days was found to be significantly associated with all-cause mortality with a relative risk of 1.023 (95% CI 1.010-1.036) per mm increase in rainfall. A similar increased RR of 1.020 (95% CI 1.007-1.034) was observed in the lag strata 7-13 days before in the group of non-communicable disease causes of death. For temperature, the greatest relative risk of deaths was observed for external causes of deaths with a lag of 0 to 1 weeks amounting to relative risk of 1.176 (95% CI 1.051 1.317). Conclusions: The relatively small size of the study population may have limited the detection of significant associations. No statistically significant association was found between rain or temperature and communicable diseases. We are confident that further investigation in to understanding mechanism and processes involved in determining association of weather on population health using longitudinal HDSS data would help evidence based interventions to control such diseases.

Abstract Number	**S-1-38-02**
Presenter	David Hondula*, Joacim Rocklöv, Osman Sankoh
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	review

The weather and climate at select INDEPTH sites in Africa and Asia: Historical trends, future projections, and considerations for time series modeling

Background: Research initiatives including the INDEPTH CLIMO project are extending understandings of the relationships between weather, climate, and health to new locations across the globe. In particular, research is expanding to low- and middle-income countries (LMICs) whose populations may be more vulnerable to negative health outcomes associated with extreme weather and shifts in climate. Historical meteorological data and projections of future climate are critical components in estimating current and future weather-health impacts, and thus it is important for the epidemiological community to be familiar with the availability and reliability of meteorological data at these new sites as well as their climatology. Aims: To document the climate profiles of select sites within the INDEPTH Network, including a review of the availability, quality, reliability, and scale of meteorological observations and climate projections. Methods: We developed a climatology for four locations in the INDEPTH network using historical instrumental observations and reanalysis products. Where possible, we compared these two different data sources. Future trends were analyzed using global climate model projections. Results: For some locations the availability of reliable and representative meteorological records can limit confidence in estimates of weather-health relationships. The climatological profiles of the sites we examined suggest that the variables driving weather-health relationships vary from site to site. The degree of projected climate change in the sites we examined sensitive to scenario and model choice. Conclusions: Weather and climate data resources are available to support research efforts to expand collaborative climate-heath research to LMICs. Representative and reliable meteorological data are critical to the effort to help populations in these locations reduce current and future health burdens related to weather and climate.

Abstract Number	**S-1-38-03**
Presenter	Thaddaeus Egondi*, Catherine Kyobutungi, Sari Kovats, Kanyiva Muindi, Remare Ettarh, Joacim Rocklov
Exposure	climate change (temperature)
Health domains	no health domain
Type of research	time series study

Time series analysis of weather and mortality patterns in Nairobi

Background: Association between weather and daily mortality has been well established in developed countries. However, little is known about this relationship in urban populations in sub-Saharan Africa. The climate in sub-Saharan Africa vary largely with the location, in the case of Nairobi, Kenya, it is characterized by a relatively large daily temperature ranges. Also, the weather variation in urban areas is related to the urban heat islands. Aims: The study aim was to describe the relationship between weather and daily mortality in Nairobi, Kenya, and assess the relationship by cause of death, age, and sex. Methods: The study used mortality data from the Nairobi Urban Health and Demographic Surveillance System and weather data was obtained from Kenya Meteorological Department. The study covered a population of about 60,000 during the period 2003-2008. The daily weather effect on mortality was assessed using time series Poisson regression models with distributed lag to model the delayed effect. Results: High temperatures were significantly associated with mortality in children and non-communicable disease deaths. All-cause mortality increase by 3.0% for shorter lags of same day and previous day for one degree decrease from 18oC. Mortality among older people and children under 5 years appeared most susceptible to cold compared to other age groups. Rainfall, in the lag period of one month, increased all-cause mortality in general, but was found strongly related to mortality among females. Low temperatures were associated with deaths due to acute infections, whereas rainfall was associated with all-cause, pneumonia and NCD deaths. Conclusions: The results support significant temperature-related mortality in Nairobi with differences by age, sex, and cause of death. The study finding points to the need for further research to establish a better understanding of the processes and mechanisms involved in order to develop preventive strategies.

Abstract Number	**S-1-38-04**
Presenter	Sari Kovats*
Exposure	climate change (temperature)
Health domains	other
Type of research	review

Weather related mortality in high-, middle- and low-income countries - differences and similarities

Background. The increased number of publication of time series studies of the short term effects of weather on daily mortality facilitates a more detailed comparison of temperature- (and rainfall) mortality functions across populations. There is a lack of evidence regarding weather effects in tropical and sub-tropical climates. Aims. To review published studies on weather effects on daily mortality in low, middle and high income countries, and describe important differences in response functions between populations. Methods. Review published studies that quantify the impact of temperature and rainfall on daily mortality outcomes in populations in high, middle and low income countries. Results: Published studies from low income countries or in tropical climates include several from the CLIMIMO collaboration that used demographic surveillance data from the inDEPTH network. Both high and low temperatures increase the risk of acute mortality in most populations in low and middle-income countries, with cold effects dominating in some populations. The heat and cold effect estimates (slopes) and thresholds are quite heterogeneous. Differences in effects in adults, children and the elderly reflect the underlying disease profiles, particularly where mortality from infectious diseases is high. Rainfall effects are particularly important in rural populations where malaria mortality is high. Conclusions: Population specific weather-health relationships are determined by climate and non-climate factors. Urban and rural populations in low and middle income settings have different health profiles and socio-economic determinants of health status which make them more susceptible to weather effects, particularly in children. Epidemiological analyses can provide limited information on the causal mechanisms by which environmental temperature and rainfall affect acute mortality. Lack of long-term and daily time series data on health outcomes in low income settings remains a limitation to research on short-term health effects.

Abstract Number	**S-2-06-01**
Presenter	Chirag Patel*
Exposure	gene-environment interactions
Health domains	diabetes
Type of research	cross-sectional study

Environment-Wide Association Studies (EWAS) and Gene-by-Environment Wide Association Studies (GEWAS) to find genetic and environmental factors in disease

Background: The promise of the “exposome” – the totality of environmental exposures encountered from birth to death– includes ascertaining complex influence of the personal environment in disease. However, we currently lack both methodology and data to connect the exposome with health status. The case is different in genomics, where we have capability to associate millions of genotypes – places in the genome where we differ – with disease in studies such as the “Genome-wide Association Study” (GWAS). We claim that we can borrow methods in genomics to connect multiple personal exposures, and genetic factors that interact with exposures, in type 2 diabetes (T2D). Aim: We aim to describe a first Environment-wide Association Study (EWAS) connecting multiple markers of exposures to disease and disease-related phenotypes. Second, we describe a way to search for gene-environment interactions in T2D. Methods: We have extended methods used in GWAS to implement EWAS, examining participants in the US National Health and Examination Survey (NHANES). NHANES contains >300 biomarkers of exposure and >500 genetic variants in 200-9000 participants. We correlated each biomarker of environmental exposure with T2D. Next, we conducted a GEWAS, searching for interactions between EWAS-identified exposures and GWAS-identified genotypes in T2D. Results: We found 5 environmental exposures including 2 persistent organic pollutant markers associated with T2D, heptachlor epoxide and PCB170. For higher levels (1SD change) of these factors resulted in greater than 3 fold increase in T2D prevalence. We found 3 nutrient factors associated with T2D, and furthermore, we found a genetic variant-by-environment interaction with these 3 nutrients in T2D. Conclusion: We have demonstrated a systematic approach to searching for exposures and interactions between exposures and genetic variants in complex disease. Such an approach may help identify a substantial component of disease risk and/or pathology.

Abstract Number	**S-2-06-02**
Presenter	Joel T. Dudley*
Exposure	others
Health domains	other
Type of research	others

Using integrative informatics to bridge toxicogenomics and disease biology

Traditional epidemiological methods for associating environmental exposures to human health are often limited in their ability to uncover molecular mechanisms that link molecular perturbations induced by a chemical exposure to pathophysiology. Additionally, traditional methods based on investigating exposed populations provide limited opportunities to construct predictive toxicogenomic models capable of identifying health liabilities of chemical exposures prior to observing manifestations of their potential deleterious effects in a population. The goal of this study is to develop and apply integrative informatics methodologies that incorporate existing molecular data from human diseases and chemical perturbagens to identify novel links between chemical exposures and disease pathophysiology. We developed a novel method that integrates disease molecular profiles from the NCBI Gene Expression Omnibus (GEO) with molecular signatures of chemical exposures constructed from representative data in the Comparative Toxicogenomics Database (CTD). This method employs a statistical approach to identify synergistic molecular patterns overlapping between disease states and chemical exposures, which suggest that an exposure could induce or exacerbate pathological molecular states in human tissues. We applied this method to multiple molecular profiles of breast cancer to identify chemical exposures that induce molecular patterns that are significantly synergistic with multiple representations of the disease state. Our analysis identified many chemical agents, such as Polychlorinated biphenyls (PCBs), which are known to modulate the pathophysiology of breast cancer. This study demonstrates the utility and potential for developing and applying integrative informatics approaches to enable predictive toxicogenomics and to identify putative molecular mechanisms underlying associations between chemical exposures and human disease states.

Abstract Number	**S-2-06-03**
Presenter	Miquel Porta*
Exposure	persistent organic pollutants
Health domains	physical activity
Type of research	exposure measurement

Timing and concentrations of multiple environmental exposures in the general population

Background: Surveys of human exposure to chemicals do not integrate the number of compounds detected per person and the concentration of each compound. This leaves untested relevant exposure situations; e.g., whether individuals with low concentrations of some compounds have high concentrations of the other compounds. Analyses of the concentrations of a given compound usually show that most citizens have much lower concentrations than a certain minority. Aim: To analyse the number of persistent toxic substances (PTS) detected at high concentrations in a general population. Methods: Serum concentrations of 19 PTS were analysed by gas chromatography with electron-capture detection in a representative sample of the general population of Catalonia, Spain (N = 919). Results:Over 58% of participants had concentrations in the top quartile of ≥1 of the 8 most prevalent PTS, and 34% of ≥3 PTS. 83% of women 60-74 years had concentrations of ≥3 PTS in the top quartile; 56% of women 60-74 y had p,p'-DDE, HCB and b-HCH all in their respective top quartiles, and 48% had concentrations of ≥6 PTS in the top quartile. Over 30% of subjects had concentrations in the top decile of 1 to 5 of the 8 most prevalent PTS. Half of the population had levels of 1 to 5 PTS >500 ng/g. Less than 4% of citizens had all 8 PTS in the lowest quartile. Conclusions: Our analysis integrated the number of compounds detected per person and the dose of each compound. More than half of the population had concentrations in the top quartile of ≥1 PTS. Significant subgroups of the population accumulate PTS mixtures at high concentrations. PTS concentrations appear low in most of the population only when each individual compound is looked at separately. It is not accurate to state that most of the population has low concentrations of PTS. The assessment of mixture effects must address the fact that most individuals are contaminated by PTS mixtures made of compounds at both low and high concentrations.

Abstract Number	**S-2-08-01**
Presenter	Gary Adamkiewicz*, Meryl Colton, John D. Spengler
Exposure	household air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Differences in satisfaction, comfort and air quality between conventional and green public housing: A case study in Boston

Background: The home environment can be an important determinant of resident health, especially within low-income populations. 'Green' housing is designed to use low-impact materials, increase energy efficiency and improve occupant health; however, few studies have measured these qualities. Aims: To compare resident-reported health, satisfaction, and comfort between green and conventional units in Boston public housing developments. Methods: We conducted surveys and visual inspections in 230 households during the baseline visit of a longitudinal study of green and conventional public housing. The survey captured relevant indoor environmental qualities including: temperature/humidity, lighting, noise, pests, mold, smoking, and health. We compared differences in self-reported comfort and satisfaction between housing types using parametric or nonparametric tests as appropriate. In addition, we measured CO2, temperature, and humidity over a 7-day sampling period coincident with survey administration in a subset of units in each housing type (n=25). These measurements, coupled with the visual inspection, were used to validate the environmental characteristics related to resident comfort and satisfaction. Results: In preliminary analyses, several statistically significant ($p<0.05$) differences were observed between conventional and green housing. Among residents of green housing, there were improved perceptions of overall air quality during both winter and summer. Specifically, green units had fewer reports of humidity extremes (too dry/humid), overheating, mold growth, and cockroach activity. Among symptoms experienced in the prior month, only headaches and skin rashes were reduced in green homes ($p<0.05$). No differences were observed for overall self-reported health. Conclusions: In bivariate analyses, residents of green units report improved conditions in multiple domains of comfort and satisfaction. In our full analysis, we will explore how apartment characteristics, occupant behavior, and demographics are related to these differences.

Abstract Number	**S-2-08-02**
Presenter	David Jacobs*, Sherry Dixon, Jill Breysse, Samuel Dorevitch, Lorraine Conroy
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	review

Do Weatherization and Rehabilitation of Low-Income Housing Using Green Healthy Homes Techniques Improve Health Outcomes and Indoor Environmental Quality—Three R

We review 3 studies on health outcomes associated with weatherization and/or green healthy housing rehabilitation. All used a standardized self-reported health questionnaire and visual assessment and air sampling for CO, CO2, VOCs, formaldehyde, and/or NO2. The Moving Into Green Healthy Housing—The Yield in Health (the MIGHHTY) study (n= 325 homes) examined Medicaid data, with the DC Green and the Watts to Well-Being studies having n=25 and n=248 homes, respectively. The MIGHHTY study showed housing conditions, general health, asthma, hay fever, headaches, sinusitis, angina, respiratory allergy, child behavior and mental health (sadness, nervousness, restlessness) all were statistically significantly better compared to both the control group and the public housing from which participants moved. Children with asthma had significantly lower use of urgent care, frequency of symptoms, difficulty staying asleep and use of a prescription inhaler compared to the control group. Air contaminants were lower than applicable guidelines. Medicaid data were inconsistent with self-reported health and housing quality, possibly due to age, recall, Medicaid eligibility and policy, and others. The DC Green study showed adult general health significantly improved and apartments had large significant improvements in dampness; cockroaches; rodents, reduced pesticide use; and reduced Bla g1 and mouse Mus m1 allergens. The Watts To Well-Being study showed significant improvements in adult general health, sinusitis, hypertension, overweight, use of asthma medication and low air contaminants. Using modern green healthy housing principles in low-income housing produces substantial health benefits. An on-going study of elderly public housing residents in green rehabilitations will also be covered. Further work is needed to quantify health cost savings associated with improved housing.

Abstract Number	**S-2-08-03**
Presenter	Ulla Haverinen-Shaughnessy*, Virpi Leivo, Dainius Martuzevicius
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

Early results of a study on improving energy efficiency of housing stock, IEQ and public health in North-East Europe

BACKGROUND/AIMS: The INSULAtE project aims to demonstrate the effects of improving energy efficiency (EE) of dwellings on indoor environmental quality (IEQ) and public health, and to develop a common protocol for assessment of these effects related to national policies and programs implementing the European Energy Performance of Buildings Directive. METHODS: In the first phase, 20 case and control buildings from both Finland and Lithuania are included. The case buildings are multifamily buildings undergoing renovation improving EE, such as adding thermal insulation or changing windows. Measurement data on IEQ parameters (inc. 24h monitoring of PM, CO, and CO2; 1wk passive sampling of VOCs, formaldehyde, and NO2; 2mo monitoring of T and RH; 2mo passive sampling of radon and settled dust) and questionnaire data on occupant health are collected from 5 apartments per building both before and after renovation. Since the winter of 2011-2012, data have been collected from 65 (before) and 7 (after) apartments from Finland, and 82 (before) and 4 (after) apartments from Lithuania. RESULTS/CONCLUSIONS: At this point, data are available (i.e. samples analyzed and data entered in the database) from 22 apartments from Finland and 32 - 82 apartments from Lithuania before renovation. We interpret the findings relative to national reference or guideline values. Preliminary screening of the data reveals thermal index values below recommended (TI = 65) in 11 of 22 apartments in Finland and 34 of 82 in Lithuania. In Lithuania, recommended level of CO2 (1200 ppm) was exceeded in 22 of 76 apartments, formaldehyde concentration was > 0.01 mg/m3 in 32 of 39 apartments, NO2 > 0.04 mg/m3 in one of 61 apartments, and ethylbenzene > 0.02 mg/m3 in one of 39 apartments. All other values (inc. RH, CO, TVOC, and radon) were within recommended limits or data not yet analyzed (inc. microbial levels and mineral fibers in settled dust as well as occupant questionnaire data) in both countries. We will present preliminary results from before and after renovation measurements, and discuss the implications on the assessment protocol development.

Abstract Number	**S-2-08-04**
Presenter	Paul Francisco*, Salvatore Cali, David Jacobs, William Rose
Exposure	household air pollution
Health domains	healthrelated quality of life
Type of research	case-control study

Ventilation and IAQ in Homes Receiving Energy Efficiency Retrofits

Residential energy efficiency programs in the United States have become increasingly aware of the need to consider the indoor air quality impacts of the energy-based measures that are implemented. This has resulted in a shift from referencing outdated ventilation standards to incorporating ASHRAE Standard 62.2. Because this shift has resulted in substantial concern from program implementers regarding the cost of increased ventilation requirements, research on any benefits of this change is warranted. This presentation provides preliminary data from such a study. This study, which is still underway, implements the older ventilation standard in half of the homes and the current standard in the other half. In all homes, building air leakage reductions are measured before and after retrofit, along with indoor concentrations of a number of common contaminants, including carbon monoxide, carbon dioxide, formaldehyde, total VOCs, radon, and humidity. Existing ventilation is characterized, and additional ventilation to meet the applicable ventilation standard is documented. In addition, health surveys are administered to the occupants before retrofit and a minimum of 6 months after retrofit. This presentation will discuss changes in contaminant concentrations from before to after retrofit, corrected for outdoor weather factors. These changes will be evaluated separately by which of the two ventilation standards was used. Additionally, the total ventilation rates for the two groups will be presented, and the contaminant concentrations will be analyzed based on total ventilation rate, including natural and mechanical sources. Results of the health surveys will not be presented because at this time the sample size of fully completed houses is too small to draw any preliminary conclusions. Because the study is still underway the data presented should not be considered as representing the final conclusions of the study.

Abstract Number	**S-2-08-05**
Presenter	Susan Doll*, Sarah Grady, Lukas Burgher, Nathan Culver
Exposure	household air pollution
Health domains	no health domain
Type of research	exposure measurement

Weatherization, IEQ and Building Performance: Study Methodology and Pre-weatherization Baseline

The accelerated rate of implementing energy-efficiency measures in residential homes is outpacing our knowledge of the potential impacts on the indoor environment quality (IEQ). To address both the occupant exposure and potential contributing factors, real-time data (temperature, %RH, CO2, CO, particulate matter, total volatile organic compounds, formaldehyde, radon) were collected in pre-weatherization homes during the 2012-2013 heating season. Average NO2 values were also collected using passive samplers. Participants were recruited from ongoing Weatherization Assistance Programs through partnerships with community action agencies located in North Carolina's diverse mountain and coastal zones. Other data being collected for analyzing pre/post-weatherization differences, include participant activities, exhaust fan and blower door measurements, building features, and occupant characteristics (smoking, pets). Results for data from ten pre-weatherization homes at each location indicate the following: CO, formaldehyde, NO2, and radon below acceptable levels in all test homes, except one with high NO2; six homes, somewhat elevated TVOCs (five in the mountains); eleven homes, elevated PM2.5 (eight at the coast); three homes carbon dioxide above 1000ppm. Comparison of homes with and without forced air heating systems show significantly higher counts of particulate matter in homes with forced air systems: an order of magnitude more 0.3 mm and 0.5 mm particles; similar amounts of 1.0 mm, 2.5 mm particles; and 50-100% more 5.0 mm and 10 mm particles. Average values for outdoor samples at both locations indicate that all parameters are less than indoor values, except values for particle sizes 1.0 mm, 2.5 mm, 5 mm, and 10 mm at the coastal location. Additional analysis comparing data from two NO2 passive samplers and two wind speed sensors at WAMY study homes, showed good agreement (< 2ppb) for the NO2 samplers, and an average difference of 45% for the wind speed sensors.

Abstract Number	**S-2-11-01**
Presenter	Brenda Eskenazi*, Kim Harley, Paul Yousefi, Karen Huen Northcoate, Asa Bradman, Lisa Barcellos, Nina Holland
Exposure	pesticides
Health domains	neurobehavioral effects
Type of research	cohort study

CHAMACOS: A Birth Cohort Study in an Immigrant Population

Background. Epigenetic mechanisms may provide a link between environmental exposures and effects on children's health and provide clues for possible interventions. Birth cohorts with repeated collection of biological material can allow for an evaluation of epigenetic changes from thein utero period through childhood. Aims.To describe the CHAMACOS birth cohort study and the use of measures of DNA methylation to link environmental exposures and child health. Methods.We enrolled 601 pregnant women primarily of Mexican origin and have followed their children (currently 12 years old). We measuredin uteroand child exposure to numerous environmental agents in stored biological samples. In blood samples collected from the cord (fetal blood) and from the child at age 9, we measured global and site-specific DNA methylation in by Illumina Infinium Human Methylation 450K BeadChips. Results. We have previously shown that exposure to various environmental agents have been related to fetal growth, neurodevelopment and obesity. We have now begun to examine whether epigenetic changes may mediate these associations. We observed that approximately 15.5% of all investigated CpG sites were differentially methylated between the fetal period and age 9. We also found a significant difference in methylation by sex. Markers of DNA methylation will be examined in relation to prenatal exposure to environmental pollutants and as mediators of children's health. Conclusions.Birth cohort studies can allow for the investigation of the role of epigenetics in mediating the relationship of environmental exposures and health of children. Acknowledgements: This work was supported by PO1 ES009605 and R01 ES017054 from the NIEHS and R82670901, RD83171001, and RD83451301 from the U.S. EPA.

Abstract Number	**S-2-11-02**
Presenter	Adrienne Ettinger*, Andrea A Baccarelli, Chitra Amarasiriwardena, Letizia Tarantini, Benedetta Albetti, Robert O. Wright
Exposure	metals
Health domains	reproductive outcomes
Type of research	cohort study

DNA Methylation and Exposure to Multiple Metals during Pregnancy among Women Living near a Superfund Site

Background: Evidence suggests that metals may influence epigenetic phenomena, such as DNA methylation, which regulate gene expression. Early life exposures may program later disease outcomes, thus, pregnancy is an important period of interest for studying these relationships. Aims: To evaluate DNA methylation and exposure to multiple metals during pregnancy among women living near the Tar Creek Superfund site in Oklahoma (USA). Methods: We used PCR-Pyrosequencing® to quantify global methylation inAlu andLINE-1 repetitive elements in bisulfite-treated DNA derived from peripheral blood leukocytes of 167 women. Gene-specific methylation was also assessed in the imprinted lociH19 (non-protein coding RNA transcript promoter andH19 ICR, differentially methylated domain) andKCNQ1 (potassium voltage-gated channel, KQT-like subfamily, member 1) and the non-imprinted glucocorticoid receptor gene (GCR). The degree of methylation was expressed as the percentage of methylated cytosines divided by the sum of methylated and unmethylated cytosines (%5mC). Arsenic, lead, and manganese blood concentrations were measured using inductively-coupled plasma mass spectrometry. Results: Mean (± SD) blood concentrations (microg/dL) of arsenic, lead, and manganese, respectively, were: 1.8 (1.2), 0.8 (0.5), 2.4 (1.2). Arsenic was associated with hypomethylation inH19 (p=0.02) while lead was associated with global hypomethylation measured byLine-1 (p=0.02) and also hypomethylation inGCR A11Beta (p=0.04). Manganese was associated with hypomethylation inGCR NR3C1 (p=0.05) and hypermethylation inKCNQ1 (p=0.06) Conclusions: The associations between metals exposure during pregnancy and epigenetic alterations in both imprinted and nonimprinted loci may have implications for the biological mechanisms of action and also suggests that changes in DNA methylation may represent an important biomarker of early biologic effects.

Abstract Number	**S-2-11-03**
Presenter	Eva Morales*
Exposure	persistent organic pollutants
Health domains	respiratory disease
Type of research	cohort study

Epigenetic effects of intrauterine exposure to persistent organic pollutants, the INMA birth cohort

Background: Prenatal environment can be recorded in offspring as changes in epigenetic marks. Aims: In the INfancia y Medio Ambiente (INMA) Project, we have investigated: 1) cord blood gene specific DNA methylation changes in relation to prenatal dichlorodiphenyldichloroethylene (DDE) exposure and risk of asthma-related phenotypes, and 2) placental changes in global DNA methylation in relation to prenatal exposure to xenoestrogens. Results: In the first study, the discovery phase using the Illumina GoldenGate Panel I identified lower DNA methylation at a CpG site in the arachidonate 12-lipoxygenase (ALOX12) gene in children having persistent wheezing compared with those never wheezed at age 6 years in the INMA Menorca cohort (p=0.003). Pyrosequencing confirmed that DNA hypomethylation at ALOX12 loci was associated with higher risk of persistent wheezing in the INMA Menorca cohort (OR per 1% methylation decrease, 1.13; 95% CI, 0.99–1.29; p= 0.077) and in the INMA Sabadell cohort (OR, 1.16; 95% CI, 1.03–1.37; p=0.017). Higher levels of prenatal DDE, previously associated with risk of persistent wheezing, were associated with DNA hypomethylation of ALOX12 in the Menorca cohort (p=0.033), but not in the Sabadell cohort (p=0.377). ALOX12 DNA methylation was strongly determined by underlying genetic polymorphisms. In the second study, total effective xenoestrogen burden (TEXB) was measured in placenta (n=200, 50% males). The % of DNA 5mC was analyzed on 10 different repetitive elements (4 LINEs, 3 Alus and 3 HERVs) per duplicate by bisulfite pyrosequencing. One to five CpG sites were analyzed and average methylation levels were regressed over tertiles of TEXB levels. After adjustment, higher TEXB levels (3rd vs. 1st tertile) were associated with an increase in methylation of 1.2% in one of the LINE1 elements (L1PA5) (p <0.001), without significant sex interactions. Conclusions: Assessment of epigenetic marks in offspring could help to unravel mechanisms underlying adverse effects of chemical exposures in development.

Abstract Number	**S-2-11-04**
Presenter	Luca Lambertini*, Carmen Marsit, Jia Chen
Exposure	metals
Health domains	neurodevelopment
Type of research	cohort study

Genomic Imprinting and the Effects of the Environment on Fetal Growth

Background: Genomic imprinting refers to the monoallelic, parent-of-origin specific, expression of a subset of about 200 genes (1%) of the human genome. Imprinted genes are critical for fetal brain development. Imprinted genes respond to environmental signals in pregnancy and their dysregulation have been tied to many neurodevelopmental syndromes. The majority of the imprinted genes is expressed in placenta, which functions as the interface between the developing fetus and the environment. Aims: We profiled the expression of 22 imprinted genes in placentas from the Rhode Island Child Health Study which is enrolling mother-infant pairs. The resulting expression profiles were analyzed to investigate their correlation with birth measures, infant neural outcomes, measured by the Neonatal Intensive Care Unit Network Neurobehavioral Scales (NNNS) test, and Arsenic (As) and Manganese (Mn) concentrations in toenails. Methods: Imprinted gene expression was profiled by real-time PCR. Expression values were correlated to birth measures and As and Mn concentrations by linear models and to the NNNS scores by recursively partitioned mixture modeling (RPMM) and linear models. Results: Two imprinted gene clusters, including 16 of the 22 genes tested, were found to antagonistically determine the head circumference on newborns. Cluster 1 promoting bigger and cluster 2 smaller head circumference (r2=0.318 – p<0.001). Cluster 2 was also found to correlate with low birth weight (r2=0.390 – p<0.001) and small for gestational age (r2=0.270 – p=0.001). RPMM defined 4 classes of placental imprinted gene expression. Linear regression models identified significant differences in handling (p=0.006) and quality of movement (p=0.020) scores by class. Significant associations between expression and As and Mn exposure was found for genes belonging to cluster 2 and RPMM classes 2 and 4. Conclusions: These results suggest that trace metals correlate with imprinted gene expression in placenta possibly limiting both fetal growth and neurodevelopment.

Abstract Number	**S-2-11-05**
Presenter	Allison Appleton*, David Armstrong, Barry Lester, Carmen Marsit
Exposure	others
Health domains	neurobehavioral effects
Type of research	cohort study

Patterning in placental DNA methylation and infant neurodevelopment according to prenatal socioeconomic environment

Background: Prenatal socioeconomic adversity (SA) is associated with poor infant neurodevelopment yet the mechanisms are not well understood. Fetal development can be shaped by the intrauterine environment through alterations in the function of the placenta. In the placenta, the HSD11B2 gene encodes the 11-beta hydroxysteroid dehydrogenase enzyme and the glucocorticoid receptor (NR3C1), both of which are key elements of the stress response, are regulated by DNA methylation and can be influenced by a variety of environmental stressors. However, the association of prenatal SA and placental methylation of HSD11B2 or NR3C1 has not been examined, and the impacts of such methylation on infant neurodevelopment are unknown. Aims: We examined whether prenatal SA would be associated with HSD11B2 and NR3C1 methylation and whether various levels of HSD11B2 and NR3C1 methylation in combination would be associated with different profiles of neurodevelopmental risk in infancy. Methods: We examined the association between DNA methylation of HSD11B2 and NR3C1 in the placenta of 445 healthy term newborn infants and several markers of prenatal SA. We also examined the association of HSD11B2 and NR3C1 methylation with classes of infant neurodevelopment as measured by the validated NICU Network Neurobehavioral Scales. Results: Infants with the greatest levels of prenatal SA had the lowest extent of placentalHSD11B2 andNR3C1methylation ($p<0.05$). Infants with lowNR3C1 methylation and also highHSD11B2 methylation were more likely to have a healthy neurodevelopmental profile ($p<0.05$) whereas infants with highHSD11B2and highNR3C1 methylation were more likely to have dysregulated neurodevelopment ($p<0.05$). Conclusions: Patterns of HSD11B2 and NR3C1 methylation suggest that environmental cues transmitted during gestation may program the developing fetus’s response to an adverse postnatal environment and may also influence neurodevelopmental risk and resilience.

Abstract Number	**S-2-12-01**
Presenter	Wolfgang Babisch*
Exposure	noise
Health domains	cardiovascular disease
Type of research	review

Challenges of noise effects' research

Background: The question at present is no longer whether noise affects the cardiovascular system, it is rather: what is the magnitude of the effect and what is the threshold? Aims: This introductory overview addresses various methodological aspects of noise effects' research. Methods: Based on practical examples, the impact of study design, exposure assessment, confounding and effect modifying factors is explored. Results: Sleep disturbance, hypertension, diabetes, ischaemic heart diseases and stroke have been identified as major health endpoints. Both, the direct innervation of the nervous system and the indirect emotional stress response affect the organism. Most currently available noise maps refer to the major road network. Sound levels in side streets may also be high due to close distance and bad road surfaces. Average noise levels do not fully describe the impact of single sound events. Noise effects are dependent on the activities of the individual that are disturbed (e. g. communication, concentration, relaxation, sleep). A whole day noise dosimetry would be inappropriate in this respect. Exposure-response relationships differ for different noise sources because of different sound characteristics (e. g. road, rail, aircraft, occupational). Noise effects do not always follow a toxicological dose concept; "decibels do not behave like micrograms/cubic metre". Air pollution is a potentially confounding factor of noise effects - and vice versa – particularly with respect to road traffic noise. Disentangling the effects of both exposures is difficult, because both factors refer largely to the same source and the calculation models use the same input data (traffic volume, proximity). The effect modifying impact of age, gender, disease status, length of residence, location of rooms, noise sensitivity, noise annoyance and coping strategies is not yet fully understood. Conclusions: Noise studies can be improved for better quantification of the public health risk.

Abstract Number	**S-2-12-02**
Presenter	Jurgita Lekaviciute*, Yvonne de Kluizenaar, Helga Laszlo, Anna Hansell, Sarah Floud, Peter Lercher, Wolfgang Babisch, Stylianos Kephalopoulos
Exposure	others
Health domains	other
Type of research	others

Combined exposure to noise and outdoor air pollution and cardiovascular disease

Background: Epidemiological studies indicate that both traffic noise and outdoor air pollution may be associated with risk for cardiovascular disease. Only few studies consider these two environmental exposures together. Aims: To provide an overview of the latest knowledge on the association between environmental noise and outdoor air pollution on related cardiovascular health effects. To examine whether the evidence suggests that noise and air pollution interact or confound with each other. Methods: A search was conducted on Pubmed electronic database, retrieving the papers on the cardiovascular health effects of combined exposure to noise and outdoor air pollution. The search was limited to peer-reviewed papers published in English between 2005 and February 2013. Results: Few studies have considered the joint effect of traffic noise and air pollution on the cardiovascular system. 13 papers on cardiovascular efects of combined exposure to noise and outdoor air pollution were identified and reviewed. Road traffic noise was the most commonly investigated noise source. The main reviewed cardiovascular health outcomes included: arterial blood pressure and hypertension, coronary heart disease, myocardial infarction and stroke. The effects of additional adjustment for either noise or air pollution varied between studies. Conclusions: Both traffic noise and outdoor air pollution seemed to have an independent effects on cardiovascular health end points. There is a need of more well-designed longitudinal studies to further investigate the combined exposure from noise and outdoor air pollution.

Abstract Number	**S-2-12-03**
Presenter	Mette Sørensen*, Zorana Jovanovic Andersen, Rikke Nordsborg, Thomas Becker, Anne Tjønneland, Kim Overvad, Ole Raaschou-Nielsen
Exposure	noise
Health domains	diabetes
Type of research	cohort study

Long-Term Exposure to Road Traffic Noise and Incident Diabetes: A Cohort Study

Background: Road traffic noise at normal urban levels can lead to stress and sleep disturbances. Both excess of stress hormones and reduction in sleep quality and duration may lead to higher risk for type 2 diabetes. Aim: To investigate whether long-term exposure to residential road traffic noise is associated with an increased risk of diabetes. Methods: In the population-based Danish Diet, Cancer and Health cohort of 57,053 people aged 50 to 64 years at enrollment in 1993-1997, we identified 3,869 cases of incident diabetes in a national diabetes registry between enrollment and 2006. The mean follow-up time was 9.6 years. Present and historical residential addresses from 1988 through 2006 were identified using a national register and exposure to road traffic noise was estimated for all addresses. Associations between exposure to road traffic noise and incident diabetes were analysed in a Cox regression model. Results: A 10-dB higher level of average road traffic noise at diagnosis and during the 5-years preceding diagnosis was associated with an increased risk of incident diabetes, with incidence rate ratios (IRR) of 1.08 (95% CI: 1.02, 1.14) and 1.11 (95% CI: 1.05, 1.18), respectively, after adjusting for potential confounders including age, BMI, waist circumference, education, air pollution (NOx), and lifestyle characteristics. After applying a stricter definition of diabetes (2,752 cases) we found IRRs of 1.11 (95% CI: 1.03, 1.19) and 1.14 (95% CI: 1.06, 1.22) per 10-dB increase in road traffic noise at diagnosis and during the 5-years preceding diagnosis, respectively. Conclusions: Exposure to residential road traffic noise was associated with a higher risk of diabetes. This study provides further evidence that urban noise may adversely influence population health.

Abstract Number	**S-2-12-04**
Presenter	Mark Brink*
Exposure	noise
Health domains	other
Type of research	review

Noise-induced sleep disturbances and long-term health risks

Undisturbed sleep of sufficient length is essential for daytime alertness and performance, health and wellbeing. According to recent figures published by the WHO, sleep disturbance is one of the most deleterious non-auditory effects of environmental noise. A connection between noise exposure in the residential setting and detrimental effects on sleep and health is suggested by observational, experimental and epidemiological evidence that has been accumulated over the last decades. Maximum sound pressure levels as low as 33 dB have been shown to induce physiological reactions such as autonomic, motor, and cortical arousals (e.g., tachycardia, body movements, awakenings). Whether or not noise will induce such acute effects depends on the number of noise events and their acoustical properties, but also on situational moderators (e.g. momentary sleep stage) and individual noise sensitivity. Although clinical sleep disorders (e.g. obstructive sleep apnea) have been shown to be associated with increased risks for cardiovascular diseases, only little is known about long-term effects of noise-disturbed sleep on cardiovascular health. In the past years, several hints have surfaced that undermine the suspicion that nocturnal noise exposure may be more relevant for the genesis of long term effects than daytime noise exposure. The paper reviews the present state of research in the domain of noise-induced sleep disturbances from transportation and other noise sources, compares exposure-effect functions, critically appraises methods for the assessment of noise effects on sleep, and reviews potential mechanisms of the genesis of long term health effects due to noise-induced sleep disturbances.

Abstract Number	**S-2-12-05**
Presenter	Danielle Vienneau*, Laura Perez, Christian Schindler, Martin Röösli
Exposure	noise
Health domains	cardiovascular disease
Type of research	meta-analysis

The relationship between traffic noise exposure and ischemic heart disease: a meta-analysis

Introduction Since publication of the World Health Organization's report Burden of disease for environmental noise in 2011, several new studies on traffic noise and ischemic heart disease (IHD) have been published. There is thus a need for a meta-analytic update of risk estimates for these outcomes. Methods We conducted a systematic review and retained published cohort and case-control studies using road, rail or aircraft noise as exposure. Study-specific results were transformed into risk estimates per 10dB using generalised least squares for trend estimation of summarised dose–response data. Subsequently a random effects meta-analysis was conducted. Results We identified 6 studies for IHD incidence and 4 for mortality. Per 10dB increase in noise, the risk estimate was 1.08 (95% CI 1.03-1.13) for IHD incidence (total of 6,000 new cases). The risk estimate for IHD or myocardial infarction mortality accounting for a total of 22,000 deaths was 1.03 (0.99-1.08). Overall risk estimate was 1.04 (1.01-1.08). Conclusion Preliminary results confirm an increase risk in IHD incidence with traffic noise exposure. Future analysis will address type of traffic source and form of the exposure-response curve before the risk estimates will be used in an assessment of the external health costs of traffic in the Swiss population.

Abstract Number	**S-2-12-06**
Presenter	Danny Houthuijs*, Mette Sørensen, Regina Hampel, Dorothea Sugiri, Timo Lanki, Johanna Penell, Bente Oftedal, Enrica Migliore, Wim Swart, Gerard Hoek
Exposure	noise
Health domains	cardiovascular disease
Type of research	meta-analysis

Traffic noise and mortality in the ESCAPE study

Background: It has been suggested that long-term exposure to road traffic noise could lead to premature mortality from cardiovascular causes. Aims: To assess effects of road traffic noise exposure on cause-specific mortality in existing cohort studies in the ESCAPE project (European Study of Cohorts for Air Pollution Effects, www.escapeproject.eu). Methods: Standardised data on mortality due to all cardiovascular diseases (CVD) and due to ischemic hearth diseases (IHD) and potential confounders were analysed in ten cohorts from Finland, Sweden, Norway, Denmark, Germany, The Netherlands and Italy. ESCAPE made use of data from local assessments carried out for the first round of noise mapping in the EU (2007)or for specific cohorts. The Lden (day-evening-night equivalent level) was calculated for the most exposed façade of the residential address. Outdoor air pollution (PM2.5, PM2.5 absorbance, NO2, NOx) was assessed at the address using land use regression models. Cox regression analyses were carried out per cohort followed by meta-analysis to obtain combined effect estimates. Results: Data from 87,001 subjects from 6 cohorts (cohort ranges between 2,106 and 35,843 subjects) with a total of 1,573 deaths due to CVD and 771 due to IHD were included so far. Fifty-six % of the subjects (cohort range 27-68%) was exposed to noise levels above 55 dB Lden. The pooled hazard ratio (HR) for CVD mortality was 1.14 [95% CI 1.03-1.26] per 10 dB increase; for IHD mortality the HR was 1.12 [95% CI 0.95-1.30] per 10 dB increase. For both endpoints a threshold of 55 dB was assumed. Inclusion of air pollutants in the statistical model marginally changed the effect estimates. Statistical analyses are ongoing and will affect effect estimates. Conclusion: The ESCAPE project will provide data on the association of road traffic noise with mortality from cardiovascular causes.

Abstract Number	**S-2-13-01**
Presenter	Muralee Thummarukudy*
Exposure	waste
Health domains	other
Type of research	others

Dealing with Hazardous Wastes During Disasters

All disasters produce wastes of some kind and post-disaster responses also produce wastes. The issue of management of wastes created by disasters is becoming an increasingly important issue to be addressed in post-disaster response due to their scale, complexity, and cost. The cost of disaster waste management is crossing the billion dollar mark in some of the major disasters Some disasters, for example, tsunamis, turn everything in its path to a waste pile. Some of these materials could be hazardous materials themselves while others could hazardous but normally not considered a significant issue due to the very small quantities of chemicals present. A third stream could be materials that are not hazardous by themselves but will be converted into hazardous material due to the temperature and humidity. While waste management is a well developed technical area, DWM needs special attention and skills because of a number of unique challenges that have to be handled while dealing with debris in a post-disaster situation. A major challenge is the absence of facilities in many countries to deal with disaster generated hazardous wastes. Some disasters produce wastes that need specialized technology to handle, such as in the case of an oil spill or nuclear disasters. These facilities are not easy to be installed within a short time and might necessitate the storage of the waste in a temporary location till the time such facilities are locally established. The alternative is to transport the materials to another location, within the country or outside where such facilities are available. This decision is often made based on cost and environmental considerations, but the important fact is that it is made at the earliest so that waste does not remain un-attended or ends up getting mixed with other waste streams. The talk will elaborate on few experiences from recent disasters and suggest some approaches.

Abstract Number	**S-2-13-02**
Presenter	Olof Linden*
Exposure	waste
Health domains	no health domain
Type of research	others

Management of Waste Generated at Sea

The purpose of this presentation is to review the requirements for environmentally acceptable management of wastes transported and/or generated at sea and to highlight some issues not covered under the existing regulatory regimes. Three global legal regimes regulate the management of wastes on board ships. These are the MARPOL 73/78 Convention, the London Dumping Convention (1972) with Protocol (1996), and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The MARPOL Convention applies to waste generated at sea on vessels and platforms while the Basel and London Dumping Conventions apply to waste transported by ships at sea. The main purpose of the MARPOL Convention is to prevent discharges of oil, chemicals, sewage, solid wastes and air pollution from ships at sea. The MARPOL Convention requires ports to provide sufficient reception facilities to allow ship residues to be discharged without any undue delay. In 2005 the MARPOL Convention was amended to include restrictions of airborne pollutants from ships. However, a number of regions have gone further and introduced much stricter regulations vis-à-vis air contamination and established "Emission Control Areas". Although the regulatory regimes developed to control the pollution from ships may seem quite extensive there are a number of issues that remains unresolved and that require further action. Although in most cases illegal, in densely trafficked sea areas such as the North Sea, the Mediterranean and the Baltic, thousands of oil spills occur yearly. In addition the air emissions from the shipping sector is a significant source of contamination in many areas of the world but the process to regulate pollutants such as sulphur and nitrogen oxides goes very slowly. Another area where a lot of additional work has to be done concerns the port reception facilities. A large number of ports around the world have limited facilities and the charges discourage their use. The presentation discusses the challenges that have to be addressed in order to ensure that the management of wastes generated at sea is dealt with in environmentally acceptable forms.

Abstract Number	**S-2-13-03**
Presenter	Guéladio Cissé*, Muralee Thummarukudy
Exposure	waste
Health domains	other
Type of research	health impact assessment

Toxic and complex wastes management: Way Forward

This contribution closes the series of contributions that intended to stimulate a debate on the topic of toxic and complex wastes with a recall of the main purpose of the Basel Convention on "the control of transboundary movements of hazardous wastes and their disposal". Illustrated with some recent events in Africa and in other continents the contributions aimed at highlighting the consequences of a non-respect of such convention and the consecutive disaster for the environment and the human health. Inappropriate management of toxic wastes as well as many other kinds of "hazardous wastes" can lead to long-term risk for the environment and human health. This is a challenging and emerging area that requires bridging South, North, East and West. Joint efforts are needed from academia and from international organizations to foster international collaboration to support long term research, capacity building and concrete appropriate management strategies for further human health protection in many developing countries. This talk will mark the transition for the panel discussions with the audience by shortly putting on front a few questions that may inspire the debate.

Abstract Number	**S-2-13-04**
Presenter	Guéladio Cissé, Kouassi Dongo*
Exposure	waste
Health domains	no health domain
Type of research	health impact assessment

Toxic Waste Dumping in Abidjan: environmental concerns

On August 2006, a number of trucks discharged from a boat some unknown toxic wastes across the city of Abidjan (Côte d'Ivoire). Five hundred tons of toxic wastes were illegally dumped at a certain number of sites in the city. Pollutants were dumped on municipal waste disposal sites (Municipality of Cocody), in small canyons (Abobo and Koumassi), in proximity to a slaughterhouses (Abobo) and in water ponds (Cocody). The epidemiological investigation focused on the discharge sites in the vicinity of housing areas. Five sites in three municipalities were particularly concerned. A multidisciplinary survey was carried out by a team 3 months after the disaster. The first challenge of the team was to assess which environmental spaces or streams have been affected. The exact locations of the waste dumped sites have been established. The environmental component of the study has helped to deliver an updated mapping of points dumping sites of toxic waste, and to highlight the main environmental exposure factors in the immediate vicinity of the sites (food crops fields, urban agricultural fields, open food selling points, other farming activities). The study revealed the dynamic nature of some dumping sites, like the wastes dumped into a ravine that was flowing along a canal ending up to a water bed in Dokui. Of the sixteen discovered dumped sites, eleven of them were very close to human settlements and four sites were even located in the middle of human settlements. The wastes from each of the dumped sites have affected soils, water beds and/or surrounding farming activities (urban agriculture, livestock), at even an extent that has not been enough explored. The talk will elaborate on the difficulties for southern research institutions to deal alone with the challenges of undertaking assessment of environmental exposure to complex wastes in case of a disaster like the recent one with toxic wastes in West Africa.

Abstract Number	**S-2-13-05**
Presenter	Tiembre Issaka*, Cissé Guéladio
Exposure	waste
Health domains	healthrelated quality of life
Type of research	cross-sectional study

Toxic Waste Dumping in Abidjan: health concerns

The dumping of toxic waste in Abidjan in 2006 revealed the weakness of the local health systems in addressing such a disaster that brought about more than 102,806 medical consultations, 69 hospitalization and 17 deaths. In comparison to the emergency activities, research activities on health impacts were very limited. A team from the Swiss scientific Research Center in Cote d'Ivoire conducted in 2006 a multidisciplinary study that included the evaluation of toxic-waste related health consequences on the inhabitants of the neighborhoods where these toxic wastes were dumped. A cross-sectional descriptive and analytic study has been conducted from October 26th to December 8th targeting the population living in the vicinities of the toxic waste dumped sites. The sampling method by transect was used. This sampling technique consists in determining some virtual lines at a regular interval, so as to cover the entire geographic zone supposed to be impacted by the effect of the toxic waste. On each of these lines, were selected at a regular interval one or several households for in-house effectively exposed persons to be investigated exhaustively. Data were collected by six teams including each a physician, a healthcare agent and a guide. Out of 4,573 people surveyed, 2,369 (51%) presented some intoxications signs, dominated by headache (60%), pulmonary signs such as cough (48%), breathing difficulties (32%), thoracic pain (29%), oto-rhino laryngological signs such as nasal discharge (42%) and abdominal pain (36%). For 21% of the victims, these symptoms persisted more than 4 months after the discharge of the toxic waste, in spite of the partial decontamination of the pouring sites.These persistent signs were cough (37%), asthenia (33%), pruritus (30%), nausea and abdominal pain (29%). Most of the recommendations made after research studies, especially the total decontamination of the pouring sites, as well as the epidemiologic and sanitary surveillance of the exposed population and the realization of studies aiming at deeply exploring the health effects in the mid and long run have not been fully realized. The talk will elaborate on the lessons learned from that experience and the problematic in developing countriesof the mid and long run health impact of toxic wastes as well as of many other complex wastes.

Abstract Number	**S-2-19-01**
Presenter	Paolo Vineis*, Rob Beelen, Ole Raaschou-Nielsen, Wei W. Xun, Zorana Jovanovic Andersen, Konstantina Dimakopoulou, Klea Katsouyanni, Gerard Hoek
Exposure	ambient air pollution
Health domains	cancer
Type of research	cohort study

Association between exposure to air pollution and lung cancer incidence and mortality

Background and aimsFew studies on long-term exposure to air pollution and mortality and lung cancer incidence have been reported from Europe. Within the multi-center European Study of Cohorts for Air Pollution Effects (ESCAPE) we investigated the association between mortality and lung cancer incidence, and long-term exposure to multiple air pollutants. MethodsData from 16-22 European cohort studies were used. Residential exposure was assessed following a strictly standardized protocol as annual average concentrations of particles less than 2.5µm (PM2.5), less than 10µm (PM10), and between 10µm and 2.5µm (PMcoarse), PM2.5 absorbance, and nitrogen oxides (NO2 and NOx) using Land Use Regression (LUR) models. Cohort-specific statistical analyses using confounder models with increasing level of adjustment were conducted using Cox proportional hazards models using a common protocol. Random-effects meta-analysis was used to obtain pooled effect estimates.Results The total study population consisted of ~300,000 participants, of which 29,0765 died from a natural mortality cause and of which 2,026 developed incident lung cancer. Significant and borderline significant associations between PM10 (HR=1.22 per 10 µg/m3; 95% CI: 1.03-1.45) and PM2.5 (HR=1.22 per 5 µg/m3; 95% CI: 0.98-1.52) and the risk for lung cancer were found. A significantly elevated hazard ratio for natural cause mortality for PM2.5 of 1.07 (95% CI: 1.02-1.13) per 5 µg/m3 was found. Hazard ratios for PM2.5 remained statistically significant elevated even when only subjects with concentrations below 20 µg/m3 were included.Increased effect estimates for PM2.5 were found for stroke mortality, but not for overall cardiovascular, ischemic heart disease and respiratory mortality.ConclusionsLong-term exposure to fine particulate air pollution was associated with natural cause mortality and lung cancer incidence even over concentration ranges well below the current European annual mean Limit Value.

Abstract Number	**S-2-19-02**
Presenter	Göran Pershagen*, Raymond Agius, Bert Brunekreef, Joachim Heinrich, Manolis Kogevinas, Ursula Krämer, Rémy Slama, Jordi Sunyer
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Association between exposure to air pollution and pregnancy outcomes, respiratory diseases, infections, allergy and cognitive function in children

Background: The role of long-term air pollution exposure for development of adverse pregnancy outcomes and neurodevelopmental effects, as well as asthma and allergies,remains unclear. Aims: To quantify the impact of air pollution on adverse pregnancy outcomes and cognitive function as well as on asthma, sensitization, lung function and respiratory infections in children. Methods: A total of 16European birth cohorts with over 95,000 subjects were includedas part of the European Study of Cohorts for Air Pollution Effects (ESCAPE). Residential air pollution exposureassessment was based on measurements and land use regression modeling according to a standardized protocol. Center-specific analyses with subsequent meta-analyses and/or pooled analyses were performed. Results: Exposure to air pollution during pregnancy waslinked tolow birth weight (OR=1.18; 95% CI, 1.06-1.33, per 5 µg/m3 increase in PM2.5), as well as tomotor development impairmentin children (-0.62; -1.16 to -0.09, per 10 µg/m³ NO2). Furthermore, reductions in lung function in school children were related to air pollution exposure, with a decrease in forced expiratory volume in 1 second (FEV1) of 1.77% (0.18-3.34), per 5µg/m3 PM2.5. In addition, an association between air pollution exposure and pneumonia up to two years of age was seen (1.31; 1.06-1.63, per 10 µg/m³ NO2). No clearassociations between air pollution exposure and asthma or allergic sensitization were revealed. Additional analyses with adjustment for potential mediating factors, area-level socioeconomic status, short-term air pollution or backextrapolated exposures did not substantially change theresults. Conclusions: Our results show an association between prenatal air pollution exposure and reduced foetal growth as well as impaired motor development.Furthermore, air pollution was related to pneumonia and reduction in pulmonary function.No apparent association between air pollution and asthma or sensitization was found.

Abstract Number	**S-2-19-03**
Presenter	Rob Beelen*, Marloes Eeftens, Josef Cyrys, Ming Yi-Tsai, Kees de Hoogh, Gerard Hoek
Exposure	ambient air pollution
Health domains	other
Type of research	cohort study

Introduction to the ESCAPE project: exposure assessment

Background and aimsEstimating within-city variability in air pollution concentrations is important. Land use regression (LUR) models are able to explain such small-scale within-city variations. Transparency in LUR model development methods is important to facilitate comparison of methods between different studies. We therefore developed LUR models in a standardized way in 36 study areas in Europe for the ESCAPE (European Study of Cohorts for Air Pollution Effects) project.MethodsAnnual average PM2.5, PM2.5 absorbance, PM10, PMcoarse, NO2 and NOx were measured. PM measurements were restricted to 20 of the 36 areas. PM was measured at 20 locations, while NOx was measured at 40 locations in each area. The spatial variation in each area was explained by LUR modeling. Centrally and locally available Geographic Information System (GIS) variables were used as potential predictors. A leave-one out cross-validation procedure was used to evaluate the model performance. Measurements and modeling procedures were highly standardized. The developed LUR models were then applied to the cohort addresses to assess exposure.Results There was substantial contrast in the concentrations within and between the study areas. The model explained variances (R2) of the LUR models ranged from 55% to 92% (median 82%) for NO2 and from 35% to 94% for PM2.5 (median 71%). Small-scale traffic variables were the most common predictors. Lower R2 was related to small concentration variability or limited availability of predictor variables, especially traffic intensity. Cross validation R2 results were on average ~10% lower than model R2. ConclusionsIt was possible to develop LUR models that explained a large fraction of the spatial variance in measured concentrations. These LUR models are being used to estimate outdoor concentrations at the home addresses of participants in over 30 cohort studies.

Abstract Number	**S-2-19-04**
Presenter	Annette Peters*, Kathrin Wolf, Rob Beelen, Francesco Forastiere, Regina Hampel, Barbara Hoffmann, Nino Kuenzli, Timo Lanki
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	cohort study

Long-term exposure to air pollutants and cardiovascular disease endpoints in adults

Background. There are only few studies which investigated the association between residential long-term exposure to air pollutants and cardiovascular disease endpoints. Aims. As part of the European Study of Cohorts for Air Pollution Effects (ESCAPE) project this work package aimed to quantify the effects of long-term exposures to ambient air pollution on intermediate phenotypes of cardiovascular disease, and on the incidence of coronary artery disease and cerebrovascular disease in differently exposed populations in Europe. Specifically, we evaluated the impact of ambient air pollution on markers of inflammation (aim1), on blood pressure and prevalence of hypertension (aim2), on the risk for build-up of preclinical atherosclerosis measured by intima-media thickness (IMT) of the carotid artery (aim3), and on incident coronary events and stroke (aim4). Methods. All cohorts assessed the spatial variability of residential long-term exposure to particulate matter and nitrogen oxide using land-use regression models. Cohort-specific effect estimates were calculated and subsequently pooled using meta-analysis. Endpoint-specific confounders and effect-modifiers were considered. Results. Seven cohorts contributed to aim1 with 22,561 participants, 12 cohorts to aim2 with 98,448 participants, 4 cohorts to aim3 with 9,331 participants, and 11 cohorts to aim4 with 100,166 participants. Levels of C-reactive protein were associated with traffic exposures and nitrogen oxides. Blood pressure and hypertension were associated with traffic counts. IMT showed associations with traffic in two of the four cohorts, but not on a meta-analytical level. In contrast, the risk of coronary events was related to long-term exposure to inhalable particulate matter. Conclusions.The findings substantiate the link between long-term exposure and ischemic heart disease and indicate that chronic subclinical inflammation may contribute to these associations.

Abstract Number	**S-2-19-05**
Presenter	Tamara Schikowski*, Francine Kauffmann, Anna Hansell, Rob Beelen, Bert Brunekreef, Ursula Krämer, Jordi Sunyer, Nicole Probst-Hensch, Nino Kuenzli
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cohort study

Residential exposure to air pollution in relation to respiratory health in adults

Background and Aims Longitudinal studies on the long-term influence of air pollution on chronic respiratory disease in adults are rare. Workpackage 4 (WP4) of ESCAPE investigates in six adult cohort studies (ECRHS, EGEA, E3N, SAPALDIA, SALIA and NSHD) conducted in 12 European countries whether long-term exposure to traffic-related air pollution is associated with the a) prevalence of chronic bronchitis symptoms, b) prevalence and incidence of COPD, c) level and change of forced expiratory lung volumes, and d) the incidence of asthma. Methods Participants living at ESCAPE-sites of the geographically diverse population-based studies are included. Five studies have lung function data and all six studies questionnaire information about respiratory health outcomes. Datasets were harmonized to ensure consistency of statistical analysis (by study and meta-analyses). All participating cohorts assessed the spatial variability of PM10, PM2.5 and NOx within their communities based on the ESCAPE exposure protocol. Results There are 13'282 participants with at least two spirometric measures and 18'088 participants with questionnaire data about respiratory health information. The follow-up time varies between studies from 10 to 20 years and mean age from 42.6 to 73.5 years among studies. Long-term air pollution exposure to NOx , NO2 and high traffic intensity at the participants' homes were associated with a decline in lung function based on five cohorts and the development of COPD based on four cohorts, while the risk of chronic bronchitis symptoms and Asthma incidence did not observe a similar risk.. Overall, we detected that lung function and COPD being impacted by traffic related exposures, while results were not statistically significant for chronic bronchitis symptoms and asthma incidence. ConclusionsOur findings are heterogeneous with partly positive and some null findings for the association between long-term exposure to air pollution and respiratory outcomes.

Abstract Number	**S-2-21-01**
Presenter	Darby Jack*, Kwakupoku Asante, Narendra K. Arora, Kalpana Balakrishnan, Michael N. Bates, Patrick Kinney, Ajay Pillarisetti, Seth Owusu-Agyei, Kirk R. Smith
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	randomized trial

Design and implementation of household air pollution intervention studies in relation to birth outcomes: Results from Phase I activities in Ghana and India

Background: Randomized controlled trials (RCTs) offer the best opportunity to quantify the health impacts of household air pollution (HAP), as exposures correlate with income and other intractable confounders. Yet RCTs pose substantial challenges, including cost and potentially limited external validity. Aims & Methods: We present and critically assess two RCT pilots that focus on birth outcomes and child pneumonia. Experiences in Ghana (with the Kintampo Health Research Centre) and in India (with UC Berkeley, SRU, and INCLEN) at the SOMAARTH site are discussed. Results: In India, an initial user preference assessment of two candidate fan stoves revealed a clear winner. A subsequent pilot demonstrated the feasibility of recruiting pregnant women, ultrasound for gestational age, automated tracking of stove use, and assessing personal CO exposure. In Ghana, the search for viable interventions has been particularly arduous. Pilot work suggested that exposure reductions from passive rocket stoves are small in magnitude, but that LPG reduces exposures substantially. Securing LPG supplies presented major difficulties. Other pilot work focused on refining exposure assessment protocols to incorporate personal PM2.5 monitors. Conclusions: First, HAP research should offer a clear path from research to large-scale public health interventions. In the cases under consideration, research interventions, if successful, could be grafted on to existing antenatal care programs. Second, we underscore the importance and difficulty of identifying interventions that are both acceptable to village cooks and truly clean. In many settings this will require clean fuels, given current biomass stove technology. Third, while RCTs provide robust evidence of causality, exposure response analysis remains key, as intention-to-treat results may not extend to other interventions. RCTs should collect the detailed exposure and covariate data necessary for ER analysis.

Abstract Number	**S-2-21-02**
Presenter	Bryan Christensen*, Tamara Pilishvili, Jennifer Loo, Debbi Stanistreet, Ibrahim Sadumah, Michelle Bashin, Justus Muoki, Darby Jack, Fuyuen Yip, Nigel Bruce, Mike Sage
Exposure	household air pollution
Health domains	reproductive outcomes
Type of research	exposure measurement

Evaluation of acceptability and performance of stove options for reducing household air pollution in rural west Kenya

Background Relationships between household air pollution (HAP) and risk of key disease outcomes suggest that low levels may be needed in order to realise the majority of the potential health benefit. Such non-linear functions are likely for child pneumonia and CVD, and may apply also to low birth weight (LBW). Aim To identify whether one or more solid fuel stoves, including forced draught models, are capable of both meeting user needs and delivering low HAP levels, and would hence be suitable for future intervention studies and scaling up. Methods The study was carried out in rural west Kenya. Candidate stoves were required to demonstrate minimum 40% reduction in PM2.5 emissions in USEPA laboratory tests. A cooking demonstration was used to assess user views on those suitable for local cooking. The 6 most suitable (2 rocket, one rocket with chimney, 2 electric fan-assisted, one rocket with thermal powered fan) were then evaluated in a cross-over design in 43 homes. Following baseline measurement of fuel efficiency (KPT), kitchen concentrations (CO, PM2.5), personal women (cook) and youngest child (< 5 years) CO, and stove use with SUMS, each home used one stove type for 2 weeks, with repeat assessment using the same methods over the final 48 hrs. Qualitative interviews assessed user views on stoves and reasons for multiple stove use. After a 1-week gap, this cycle was repeated until all homes had used all 6 stoves, when focus groups were used to obtain user views comparing all stove types. PM2.5 area levels from kerosene lamps were also measured. Results Results for each stove type will be presented, including both SUMS data on multiple stove use and qualitative data on reasons for user behaviour. The role of kerosene lamps in explaining post-intervention HAP levels will be discussed. Conclusions The results will show the potential these stove options have, through both field performance and acceptability, of reaching the low levels of HAP sought for health studies and delivering substantive health benefits at scale.

Abstract Number	**S-2-21-03**
Presenter	Kalpana Balakrishnan*, Sankar Sambandam, Padmavathi Ramaswamy, Santu Ghosh, Thangavel Guruswamy, Krishnendu Mukhopadhyay, Priscilla Johnson, Sriram Chandramohan, Naveen Puttaswamy, P. Rajkumar, Vijayalakshmi Thanasekaraan
Exposure	household air pollution
Health domains	other
Type of research	cohort study

Integrated rural –urban cohorts for study of air pollution related health effects in pregnant women and children in Southern India: Walking the talk

Background: Design of intervention trials to reduce impacts of household exposures to air pollution on birth weight can be complicated by limited availability of information on baseline exposure-response relationships. We report preliminary results from the South Indian Cohort for Air Pollution and Health Effects (SICAPHE) study, which includes a pregnant mother-child cohort to examine impacts of air pollution exposures on, select birth/early childhood outcomes. Aim: To examine the association between daily average PM2.5 exposures for pregnant women and low birth weight (< 2500g) and establish continuous exposure-response relationships (using birth weight) for term births, in South India. Methods: 972 pregnant women (of the planned 1200) have been recruited from rural and urban primary health centers and 487 births have been recorded in the cohort. Exposures are being assessed through serial measurements of 24-48 hour PM2.5 area concentrations in household micro-environments together with ambient measurements. Integrated gravimetric samples are being used with real time samples, to estimate ratios of 24hr/4 hourly concentrations and allow exposure reconstructions through time activity recalls. Generalized additive models have been developed to examine the association between air pollution exposure metrics and birth outcomes while adjusting for maternal age, SES, nutritional status, parity, gestational age and sex of the infants. In addition, exposure models are being developed to predict exposures in relation to household and community level variables Results: We will present results from models developed thus far as well as describe special considerations for choice of air pollution exposure and birth outcome assessment methods in pregnant mother-child cohorts in India Conclusions: Results will likely inform design considerations for intervention trials being planned in multiple global locations to address risks from household air pollution. This study is supported by a grant from the Indian Council of Medical Research, Govt. of India.

Abstract Number	**S-2-21-04**
Presenter	Michael N. Bates*, Nick Lam, Amod Pokhrel, Kirk R. Smith
Exposure	household air pollution
Health domains	respiratory disease
Type of research	review

Kerosene—Is it really a clean household fuel?

Background. Kerosene (syn. paraffin), a petroleum distillate, has been used since the 19th Century, originally for lighting, more recently for cooking and heating. Although largely replaced by electricity and gas in the developed world, kerosene remains widely used in developing countries, mainly for cooking and lighting. Some countries subsidize kerosene to make it available to the poor, as a “clean” alternative to biomass. Problems with child poisoning and fires have long been recognized. Until recently, however, there was little investigation of the potential for health effects from emissions from burning kerosene, perhaps because it is much less visibly smoky than biomass or coal. Aim. To review the epidemiologic literature bearing on the desirability of substitution of kerosene for biomass as a household fuel. Methods. Systematic review of the epidemiologic literature on household kerosene use and health. Results. Although there have been relatively few published studies, recent studies in Nepal and India suggest that household kerosene use, at least in the simple stoves and lamps common in South Asia, may be a risk factor for tuberculosis, acute lower respiratory infection (ALRI) in young children, still births, low birth weight, neonatal death, and possibly cataract. Relative risk estimates are often comparable with those for biomass burning. For example, in a study in Nepal, the odds ratio for ALRI in children and any use of biomass stoves was 1.93 (95% confidence interval: 1.24, 2.98) and the corresponding values for any use of kerosene stoves, 1.87 (1.24, 2.83). Conclusions. Studies that have examined fuel use in developing-countries have commonly classified kerosene as “clean” or “safe”, along with gas and electricity. However, recent studies throw strong doubts on that categorization. Most of these studies are in urgent need of replication in other settings. If these effects are confirmed, they would call kerosene subsidies into question.

Abstract Number	**S-2-21-05**
Presenter	Lisa M. Thompson*, Guinevere Valencia-Moscoso, Amanda Northcross, Eduardo Canuz, Anaité Diaz Artiga, Kirk R. Smith
Exposure	household air pollution
Health domains	neurodevelopment
Type of research	cohort study

Looking back to move forward: Lessons learned from the RESPIRE trial applied to the NACER study

Background: Few studies have examined the association between household air pollution (HAP) and low birth weight (LBW). Only one study directly measured prenatal carbon monoxide exposures among women enrolled in the RESPIRE randomized stove intervention trial. Aims:The NACER pilot study builds off our earlier experience and aims to: 1) measure personal exposures to carbon monoxide (CO), particulate matter (PM2.5) and polycyclic aromatic hydrocarbons (PAHs) during pregnancy and the first year of infant life; and 2) collect standardized measures of infant weight, length and head circumference, newborn gestational age and infant neurodevelopment. Methods: Guatemalan, indigenous women were recruited through a rural Ministry of Health clinic at < 20 weeks gestation and received prenatal health exams at < 20, 24-28, and 32-36 weeks. Home visits were made 3 times during pregnancy to monitor prenatal HAP. Home visits were made within 48 hours of birth and at 1, 3, 6, 9, and 12 months to assess infant anthropometry and neurodevelopment using a validated 27-item instrument (Rapid Neurodevelopmental Assessment (RNDA)). Personal CO and PM exposures were measured using real time monitors and 5 gas-phase PAHs were measured using passive diffusion badges worn over a 48-hour period. Results: 37 pregnant women were enrolled. Gestational age was confirmed by fetal ultrasound (mean: 15.2 weeks, range 7-20.1). Eleven percent of households used open fires for cooking; 89% used deteriorated vented chimney stoves. Maternal and neonatal exposures to CO, PM2.5 and PAHs will be presented. 29% of infants were low birth weight (< 2,500 grams) and 6% were preterm (< 37 weeks). Among neonates, moderate/severe neurodevelopmental impairment were: fine motor (13%), gross motor (32%), speech (16%), cognition (32%), behavior (13%), vision (45%), hearing (39%), primitive reflexes (23%), and seizures (0). Conclusions: Maternal PM and CO exposures were significantly greater than neonatal exposures. LBW and moderate/severe neurodevelopmental impairment were both high. In a future, larger study we will measure the impact of maternal and neonatal HAP exposures on LBW, preterm delivery and infant neurodevelopmental impairment.

Abstract Number	**S-2-21-06**
Presenter	Ilse Ruiz-Mercado*, Omar Masera, Kirk R. Smith, Rufus Edwards, Kalpana Balakrishnan, Narendra K. Arora
Exposure	others
Health domains	other
Type of research	others

Metrics to evaluate use, adoption and field performance of advanced-combustion cookstoves in a fuel-device stacking context.

Background: Benefits from cookstove implementation can only occur when cleaner and more efficient stoves: 1) perform well in the field, 2) are used frequently, and 3) displace the older less efficient stoves. We use Stove Use Monitors (SUMs) to link laboratory performance to field emissions by these three parameters. Aims: To provide the metrics and the analysis methods to link laboratory performance to field performance through stove usage behavior and adoption. Methods: Test in-field performance of two advanced-combustion stove combinations: the Patsari-LPG-traditional hearths in Michoacan, Mexico and the Phillips-LPG-traditional hearths in Haryana India. Define metrics of stove use and adoption measured with the SUMs to link field measurements of fuel consumption and emission to controlled laboratory performance test. Estimate the health and climate impacts from the dominant patterns of fuel-device stacking found in the two populations. Results: In Michoacan, the introduction of the Patsari chimney-stove in a community with high LPG penetration revealed full spectrum of fuel-stove combinations, including complete abandonment of LPG as a result of switching to the Patsari in order to prepare traditional meals and save on fuel cost. In the Haryana site, continued monitoring of the Philips stove similarly indicates a wide range of use patterns, including dominant Philips use, mixed Philips and traditional stove, and exclusive use of the traditional stove. Conclusions: Preliminary results in both sites confirm groups of households using distinct combinations of stoves and fuels, with intensity of use of each device driven by the cooking/heating task that each stove can satisfy. Our study will enable identification of benchmarks for stove programs to assess whether the benefits of advanced-combustion stoves measured in the field (reductions in emissions and fuel consumption) match those promised in lab studies and to elucidate the role of stacking in the observed discrepancies.

Abstract Number	**S-2-27-01**
Presenter	Tom De Smedt*, Koen Simons, André Poffyn, Julie Francart, An Van Nieuwenhuyse
Exposure	ionizing radiation
Health domains	cancer
Type of research	health impact assessment

Alleviating ecological bias in linking radon exposure to acute childhood leukaemia

Background The relationship between indoor radon concentrations and acute childhood leukaemia is of high public health interest as many of the possible risk factors related to ionising radiation remain unknown. Associations between radon exposure and acute childhood leukaemia have been assessed in numerous ecological studies via standardized rates or regression coefficients stemming from Poisson-based generalized linear models (GLMs). There is one limiting factor in these studies: the high within-area variability of radon concentrations leading to ecological bias. Radon is a prime candidate for alleviating this bias using the within-area distribution as in many countries the indoor radon concentrations in high risk areas are monitored. Aims Development and validation of a methodology to alleviate ecological bias in ecologic studies concerning radon, using the aggregated individual risk. Methods Our method consists of calculating the aggregated individual risk in the geographical unit by explicit numerical integration of the product of the individual binomial risk and the exposure distribution in the unit. The relative risk can be estimated by maximizing the binomial likelihood using the aggregated individual risk. The aggregation makes it possible to account for ecological bias due to within-area variability. We use multiple scenarios for Monte Carlo simulations to compare our method with Poisson-based GLMs. The disease counts are generated from a binary risk model using individual exposure sampled from the measured radon distribution. The scenarios consist of a null model and several linear no threshold risk models, with increasing individual risk related to the exposure. Conclusions We use the actual within-area distribution of the radon exposure to alleviate ecological bias. Initial results show no difference for the null model but increasing bias in GLMs compared to our methodology with increasing individual risk.

Abstract Number	**S-2-27-02**
Presenter	Gerry Kendall, Richard Wakeford*, Mark Little
Exposure	ionizing radiation
Health domains	cancer
Type of research	review

Childhood Leukaemia and natural background radiation: Context and dosimetric aspects

Natural sources contribute the largest component of radiation dose to most members of the population. Can epidemiology detect the effect of these doses? Radon doses to the lung are generally much the largest to any organ or tissue from natural sources and a link between radon exposures and lung cancer is well established. Another possible group of diseases for study are childhood cancers, particularly leukaemia, which have relatively low incidence and are relatively easily induced by radiation. A number of such studies have been published. These were generally of ecological (geographical correlation) or case-control design. Ecological studies are potentially subject to confounding by effects that cannot be allowed for in the analysis. Conventional interview based case-control studies should be free of this problem but may be subject to participation or other biases and are very expensive if they are large enough to have the necessary power. Record-based case-control studies are able to overcome the latter problems. Natural background radiation comes largely from radionuclides in food, radon and thoron, terrestrial gamma rays and cosmic rays. Unfortunately it is very difficult to estimate individual doses from food. Radon and terrestrial gamma rays (with directly ionising cosmic rays) are the components commonly estimated for epidemiology. Organ doses from penetrating radiation, eg gamma rays, vary relatively little across the body. In contrast, doses from alpha-emitting radionuclides can be extremely sensitive to assumptions about the location of the sensitive cells in question and their separation from the sites of deposition of the radionuclide. Epidemiological studies can generally be conducted using only some quantity which is proportional to the organ doses (eg radon concentrations). However, even here organ dose estimates are required if the risk estimates from a study are to be compared with the literature or if power calculations are to be undertaken.

Abstract Number	**S-2-27-03**
Presenter	Martin Röösli*, Dimitri D Hauri, Ben D Spycher, Anke Huss, Frank Zimmermann, Michael Grotzer, Nicolas von der Weid, Damien Weber, Adrian Spoerri, Claudia E. Kuehni
Exposure	ionizing radiation
Health domains	cancer
Type of research	cohort study

Domestic radon exposure and risk of childhood cancer: a prospective census-based cohort study from Switzerland

Background Exposure to domestic radon is hypothesized to cause childhood leukaemia but evidence from previous research has produced inconsistent results. Aims To investigate the association between domestic radon exposure and childhood leukaemia Methods A nationwide census-based cohort study including all children aged between 0 and 15 years and living in Switzerland on 5 December 5th 2000 was conducted. The follow-up period lasted until the date of diagnosis, death, emigration, the children becoming 16 years old or 31 December, 2008. Cox proportional hazard regression models were applied, adjusted for age, gender, birth order, socio-economic status of the parents, environmental gamma radiation and period effects. Exposure assessment for each individual home address was based on a radon prediction model, developed and validated with approximately 45,000 measurements carried out all over Switzerland. Results In total, 285 childhood leukaemia cancer cases were included in the study. Compared to the group of children exposed to a radon concentration below the median (< 77.7 Bq/m³), the hazard ratio for the 10% highest exposed children (≥ 139.9 Bq/m³) was 0.99 (95% CI: 0.66, 1.49). The hazard ratios fort the intermediate exposure group (77.7-139.9 Bq/m³) was 0.87 (95%-CI: 0.67, 1.12). A separate analysis for acute lymphoblastic leukaemia (ALL), the most frequent subgroup of all leukaemias did not indicate significant associations either. Conclusions This census-based cohort study does not indicate an association between domestic radon concentration and childhood leukaemia. The observed lack of an association between domestic radon exposure and childhood leukaemia was found to be in line with estimated doses of domestic radon concentrations to red bone marrow.

Abstract Number	**S-2-27-04**
Presenter	Denis Hemon*, Claire Demoury, Géraldine Ielsch, Sophie Ancelet, Jérôme Guillevic, Dominique Laurier, Jacqueline Clavel
Exposure	ionizing radiation
Health domains	cancer
Type of research	others

Exposure to natural background radiation and association with childhood leukemia incidence in France 1990-2007

Background Several observational studies have reported associations between childhood acute leukemia and exposure to natural background radiation (NBR), but literature on low-dose ionizing radiation and childhood leukemia is still inconsistent. Aims To study the association between NBR exposure and childhood leukemia incidence in France. Methods We performed an ecological study including the 8,623 incident cases of childhood leukemia registered from 1990 to 2007 by the National Registry of Hematological children Malignancies. NBR exposure of the administrative units was obtained from three databases of the Institute for Radiological Protection and Nuclear Safety; (1) the estimates of geogenic radon potential, mapped over the French territory; (2) the measurements performed in a nationwide radon survey consisting in more than 10,000 measurements of indoor radon concentrations and/or gamma exposure in French dwellings; (3) the measurements of gamma-rays recorded in the 1,191 sites of the national TLD based surveillance system. Results The analysis of the association between NBR exposure and childhood leukemia will be presented, for radon and gamma-ray exposures at the scale of the 36,590 Communes as well as that of the 348 Zones d'emploi and 95 Départements. Specific analyses will be conducted by type of leukemia and by age. Sociodemographic characteristics of the Communes will be accounted for. Conclusions The study will provide more precise estimates of the distribution of NBR exposure among French children. The size of the study and the contrasts of exposures will permit detailed analyses of the association between NBR and childhood leukemia incidence.

Abstract Number	**S-2-27-05**
Presenter	Gerry Kendall*, Mark Little, W. Richard, Kathryn Bunch, Jon Miles, Tim Vincent, Jill Meara, Michael Murphy
Exposure	ionizing radiation
Health domains	cancer
Type of research	case-control study

Results of a record-based case-control study of natural background radiation and the incidence of childhood cancers in Great Britain

Background Although there is abundant evidence that moderate and high doses of radiation can cause leukaemia and other cancers, there is little direct evidence on the leukaemogenic (or other carcinogenic) effects of ionizing radiation at low doses and dose rates, in particular in children, suspected of being at highest risk. Aims To test the association between childhood cancers and natural background radiation. Methods Childhood cancer cases born and diagnosed in Great Britain during 1980-2006 and1-2 matched controls per case were taken from the National Registry of Childhood Tumours. Radiation exposures were estimated for mother's residence at the child's birth from national databases, using the County-District mean for gamma-rays, and from a predictive map based on domestic measurements grouped by geological boundaries for radon. Results Among 27 447 cancer cases and 36 793 controls there was 12% excess relative risk (95% CI 3, 22; 2-sided p=0.01) of childhood leukaemia per millisievert of red-bone-marrow dose from gamma radiation; the association with radon was not significant. Associations for other sites of childhood cancer were not significant for any radiation type. Excess risk was insensitive to adjustment for measures of socio-economic status, and is consistent with high dose-rate risks in the Japanese atomic-bomb survivors. Conclusions The statistically significant leukaemia risk reported in this reasonably-powered study (power ~50%) is consistent with high dose-rate predictions. Substantial bias is unlikely, and we cannot identify mechanisms by which confounding might plausibly account for the observed magnitude and specificity of the association between environmental gamma radiation and childhood leukaemia. The association is therefore likely to be causal. Our results suggest that childhood leukaemia risks extrapolated from high dose-rate data apply at natural background levels of exposure.

Abstract Number	**S-2-29-01**
Presenter	Rebecca Laws*, Daniel Brooks, Juan Jose Amador, Daniel Weiner, James Kaufman, Oriana Ramirez Rubio, Alejandro Riefkohl, Jose Marcell Sánchez Rodríguez, McClean Michael
Exposure	metals
Health domains	other
Type of research	occupational study

Biomarkers of Kidney Damage and Metals Exposure among Nicaraguan Workers

Background: In Nicaragua, an excess prevalence of chronic kidney disease (CKD) of unknown etiology has been described in young, male agricultural workers, particularly in sugarcane workers. Many potential causes have been hypothesized, including exposures to extreme heat and heavy metals, but the etiologic agent remains unknown and it is unclear whether the disease results from occupational or nonoccupational factors. Our aims include characterizing the type of kidney damage, evaluating occupational factors, and investigating the role of metals exposure. Methods: Our study population included 284 sugarcane workers representing 7 different job tasks. Blood and urine samples were collected during two rounds of sampling, at the beginning and end of the 6-month harvest season (zafra). We analyzed biological samples for cadmium, uranium, and arsenic (in urine); lead (in blood); and biomarkers of kidney injury and CKD. Results: Estimated glomerular filtration rate (eGFR) was significantly different by sugarcane job and decreased by 6.4 mL/min/1.73 m2 during the zafra in cane cutters as compared to factory workers (p=0.006). Similarly, urine NGAL differed by job, increasing most among cane cutters, by 19.2 mg/g creatinine, as compared to factory workers (p=0.04). Generally, urine albumin was low in all workers. Heavy metals were not associated with markers of kidney function, with the exception of arsenic; workers with the highest urinary arsenic levels had significantly lower eGFR (p=0.01). Conclusions: Biomarkers of kidney injury and CKD were highest among cane cutters and lowest among factory workers, supporting the hypothesis that workers performing the most intensive physical labor in the hottest conditions are at greater risk of developing CKD. The absence of albuminuria suggests a tubulointerstitial, not glomerular, disease. Finally, there is some evidence that high exposure to arsenic is associated with biomarkers of CKD.

Abstract Number	**S-2-29-02**
Presenter	Aurora Aragon*, Marvin González, Luis E. Blanco, Sandra Peraza, Catharina Wesseling
Exposure	others
Health domains	other
Type of research	others

Could CKD Among Young Male Workers be Driven by Dehydration?

Background: Acute kidney injury (AKI) has been recently identified as a strong driver for future development of chronic kidney disease (CKD). Heat stress and repeated dehydration, associated with strenuous labor in agricultural lowlands has been pointed out as a strong risk factor for repeated AKI which in turn could be responsible for the high prevalence of CKD among agricultural workers both in Nicaragua and El Salvador. Methods: Several cross-sectional studies of kidney function (i.e. estimated glomerular filtration rate, eGFR) among workers in various occupations (including agriculture, fishing, mining, coffee, and services), were carried out in low and high altitudes of Nicaragua and El Salvador. In Nicaragua, specific occupational groups were studied examining dehydration in one day of work. Results: In Nicaragua, the prevalence of reduced eGFR was considerably higher in lowland communities for younger age groups of male individuals (between 30 and 40 years of age) without other identified risk factors. Reduced eGFR was higher among mining (47%) and agricultural (in particular sugarcane) (43%) workers, as compared to a lowland service community and high altitude agricultural communities. In El Salvador it was 18% among men compared to 1% prevalence in the high-altitude communities. Some specific occupations such as sugarcane work and salt mining have shown a considerable increase of serum creatinine level after one day exposure to heat combined with heavy workload. Conclusions: These results indicate the need to increase the investigation of occupations with heavy workload and exposure to high temperature in relation to the CKD epidemic in Central America. This could allow for better understanding of what labor practices may be addressed in order to protect populations exposed to work related heat stress.

Abstract Number	**S-2-29-03**
Presenter	Kuyilan Karai Subramanian, Goru Krishna Babu*, Youssef Farag, Ravi Raju Tatapudi, Ajay Singh*
Exposure	others
Health domains	other
Type of research	others

Environmental Contamination and Chronic Kidney Disease in Southern India

Background: In a multicenter screening project in India we reported a CKD prevalence rate of 16.5%m but with tremendous center variability. The highest prevalence of CKD (48.3%) observed in Srikakulum district in Andhra Pradesh. Media reports from this area and our interviews with villagers highlighted an "epidemic of kidney failure" from environmental contamination of the water supply. We hypothesized that environmental toxicity as the cause of kidney disease in Srikakulum. Aims: 1. Determine the prevalence of CKD in villages in Srikakuum. 2. Investigate contamination of water, food or soil in Srikakulum compared to other areas. Methods: A cross-sectional study was conducted. Domicillary screening in 8 of 16 villages was carried out in 2011. Patients were interviewed and examined. Blood and urine was collected. Soil, food and water samples were sent for analysis. Results: 1152 participants were enrolled. 45.4% were male with a mean age of 44.6±14 (SD) years (range 18-95). Mean estimated glomerular filtration rate (GFR) was 95±57 ml/min/m2. The prevalence of proteinuria was 5.6%. Total prevalence of CKD was 14.6%. Hypertension was observed in 38.4% and 7.3% with diabetes mellitus. The highest prevalence of CKD of 26.2% and 23.8% was observed in primary health centers (PHC) of Akkupalli and Borivanka, respectively. In these PHCs, hypertension and diabetes were found to be 39% and 7.7%, respectively. Preliminary data from analysis of the water pointed to a high level of silica contamination in the water. Conclusions: A high prevalence of CKD in the villages of Srikakulam district was observed confirming our previous findings from a nationwide SEEK study. The villages of Akkupalli and Borivanka, both in the northeastern part of Srikakulum had the highest prevalence of CKD. Preliminary water analysis points to high silica levels in the water. Silica as a cause of CKD has been described previously.

Abstract Number	**S-2-29-04**
Presenter	Oriana Ramirez Rubio*, Juan Jose Amador, James Kaufman, Daniel Weiner, Michael McClean, Rebecca Laws, Usman Kahn, Chirag Parikh, Daniel Brooks
Exposure	others
Health domains	other
Type of research	others

Kidney Damage Markers in Nicaraguan Adolescents in a Region of an Epidemic of CKD of Unknown Etiology

Background An epidemic of Chronic Kidney Disease (CKD) is occurring across Central America, affecting, mainly among younger men. Most studies have focused on occupational factors, but the large number of cases at a young age suggests that initial damage may begin in childhood. The goal of this pilot study was to assess markers of kidney damage among adolescents before they start working. Methods We studied markers of kidney damage in 200 students (age 12-18) with no prior work history from 4 schools in different regions of Nicaragua (Jinotega, Masaya, North Chichigalpa, and South Chichigalpa). Schools represent a range of risk based on regional adult CKD mortality data. Urine was tested by dipstick and analyzed for albumin, NGAL, NAG, and IL-18, all normalized to urine creatinine concentration. Results Dipstick proteinuria (3%) and glucosuria (1%) were rare. Only 8% had an albumin to creatinine ratio (ACR) >30 mg/g. The median IL-18 level was higher than in healthy controls identified from other studies [45 pg/ml (21-115) vs. 15 pg/ml (7-28)]. Boys had lower levels than girls for all markers, particularly NGAL and IL-18. The results by school were consistent with their a priori risk: among boys, the highest mean levels of NAG, NGAL, and IL-18 occurred at the highest risk school while girls at the two highest risk schools had higher levels of NAG. Normalization for urine creatinine did not affect results. Conclusions Non-glomerular kidney damage may be present among children in an area of epidemic CKD. If confirmed, factors in addition to occupational exposure should be studied as possible causes of CKD.

Abstract Number	**S-2-29-05**
Presenter	Michael McClean*, Oriana Ramirez Rubio, Madeleine Kangsen Scammell, Rebecca Laws, Daniel Weiner, James Kaufman, Juan Jose Amador, Daniel Brooks
Exposure	others
Health domains	other
Type of research	others

Overview of the CKDu Epidemics in Central America: Current Hypotheses

Chronic kidney disease of unknown etiology (CKDu) has emerged as a major public health problem in Central American. In high- and middle-income countries, CKD is primarily caused by diabetes and hypertension and is rare among adults under the age of 60. However, in Central America, diabetes and hypertension appear to play at most a marginal role and the disease affects a much younger demographic. Although data suggest an excess of disease for at least 20 years, the epidemic has received limited attention in the broader medical and public health community. The main objective of this presentation is to describe the epidemiologic characteristics of CKDu in Central America, provide the basis for subsequent presentations on research into possible causes of the disease, and similar CKDu in Southern India. The excess of CKDu in Central America is most apparent in El Salvador and Nicaragua but seems to extend across Central America and is especially concentrated in the lowlands along the Pacific coast. Men seem to be disproportionately affected, with elevated serum creatinine levels often noted in the third or fourth decade of life. Significant proteinuria is uncommon, which supports the growing evidence that the clinical profile is most consistent with tubulointerstitial disease and not glomerular disease. The etiology of CKDu remains unknown but is likely multifactorial, potentially involving a combination of causal and susceptibility factors. To date, causal hypotheses include: volume depletion and occupational exposure to heat; environmental and/or occupational exposure to nephrotoxicants such as heavy metals, pesticides, and aristolochic acid; nephrotoxic medications such as NSAIDs (widely used in the region to treat dysuria); infections such as leptospirosis; and genetic or developmental factors. Consensus has emerged for a multifactorial etiology, with emphasis on recurrent volume depletion and heat-related injury potentially resulting in subclinical acute kidney injury that may progress to CKDu.

Abstract Number	**S-2-32-01**
Presenter	Chirag Patel*
Exposure	others
Health domains	cardiovascular disease
Type of research	health impact assessment

Environment-wide Association Studies to connect multiple personal exposures to health

Background: The promise of the “exposome” – the totality of environmental exposures encountered from birth to death– includes ascertaining complex influence of the personal environment in disease. However, we currently lack both methodology and data to connect the exposome with health status. The case is different in genomics, where we have capability to associate millions of genotypes – places in the genome where we differ – with disease in studies such as the “Genome-wide Association Study” (GWAS). We claim that we can borrow methods in genomics to connect multiple personal exposures to disease such as type 2 diabetes (T2D), heart disease and premature birth. Aim: We aim to describe a first Environment-wide Association Study (EWAS), connecting multiple markers of exposures to disease and disease-related phenotypes. Methods: We have extended methods used in GWAS to implement EWAS, examining participants in the US National Health and Examination Survey (NHANES). NHANES contains >300 biomarkers of exposure assayed in serum and urine of 200-9000 participants. We correlated each biomarker of environmental exposure with T2D, risk factors for heart disease (e.g., serum lipids), and premature birth. Results: We found over >20 environmental exposures connected with T2D and serum lipids, including markers of nicotine, hydrocarbons, and persistent organic pollutants. For example, we found two persistent organic pollutant markers associated with T2D, including heptachlor epoxide and PCB170. For higher levels (1SD change) of these factors resulted in greater than 3 fold increase in T2D prevalence. A spectrum of maternal exposures was associated with their premature birth, such as bisphenol A. Conclusions: EWAS enabled us to postulate about broad environmental correlation to prevalent diseases in the US. While subject to bias, these findings merit utility of EWAS to search for exposures connected with disease.

Abstract Number	**S-2-32-02**
Presenter	Paolo Vineis, Nicole Probst-Hensch*
Exposure	others
Health domains	other
Type of research	health impact assessment

Omics in environmental epidemiology

The identification of hazardous environmental pollutants is complex, particularly in relation to chronic, non-communicable diseases. The main contributors to this complexity are the diversity of hazards that may exist, the typically low levels of environmental contaminants/pollutants, long latency periods, and largely unknown modes of action. The unravelling of environmental causes of disease is also limited by the technical difficulties in defining, and accurately measuring exposures, and by considerable spatial, temporal, and intra-individual variation. The complex and partially unknown interactions with underlying genetic and other factors that modulate susceptibility and response to environmental exposures further complicates the process of delineating and understanding environmental hazards. To address such difficulties, the concept of the "exposome" was proposed, initially by Wild [2005], with more recent detailed development in relation to its application to population-based studies [Wild, 2012]. The original concept was expanded by others, particularly Rappaport and Smith [2010] who functionalized the exposome in terms of chemicals detectable in biospecimens. The exposome concept refers to the totality of exposures from a variety of sources including, but not limited to, chemical agents, biological agents, radiation, and psychosocial component from conception onward, over a complete lifetime, and offers a conceptual leap in studying the role of the environment in human disease.

Abstract Number	**S-2-32-03**
Presenter	Roel Vermeulen*
Exposure	others
Health domains	other
Type of research	health impact assessment

Recent exposome projects under the European Union FP7 research program: Global screening of environmental exposure-disease associations and biomarkers.

Background: Studies in migrant populations and other investigations clearly show that the 'environment' plays an important role in the etiology of many chronic diseases, but characterizing the environmental risk factors is currently far more challenging than identifying genetic factors. Aims: We recently conducted two 'proof-of-principle' studies in which the global screening of environmental exposure-disease associations and biomarkers was the central aim. In the design and conduct of these studies issues arose regarding appropriate study designs, suitability of existing biobanks, laboratory technologies, and statistical analyses. Methods: The CLEAR study is a global screening study of environmental contaminants and reproductive health in Greenlandic and European populations. The EnviroGenomarkers study is a study on identifying genomic biomarkers of environmental health with a specific focus on lymphoma. Results: Several pilot studies have been performed to study the suitability of using existing biobanked materials (i.e EPIC cohort) for exposomic research. These evaluations indicated that under certain conditions biobanked materials can be used. Statistical tools were developed to deal with nuisance variance in the laboratory analyses and methods were explored to deal with the large P small n problem. This problem refers to the fact that within exposome research it is like that the number of parameters (p) is much larger than the number of observations (n). Conclusions: These early studies on the exposome in relation to environmental diseases have shown promise with regard to the use of existing biobanked materials; have indicated methodological issues with regard to epidemiological designs; and have revealed the need for the development of statistical tools to aid the appropriate analyses of exposomic data.

Abstract Number	**S-2-32-04**
Presenter	David Balshaw, Gwen Collman*
Exposure	others
Health domains	other
Type of research	exposure measurement

The Exposome: An Approach for Untargeted Discovery in Environmental Health

As we seek to understand the influence of environmental exposures on human health, it has become apparent that new approaches are needed to supplement the traditional focused analyses common to environmental epidemiology and toxicology. The concept of the exposome, with its focus on exposures to combinations of factors across broad time scales and integration of both external and internal measures of exposure with molecular and physiological response promises to allow the generation of unique hypotheses for subsequent targeted analyses through either mechanistic or epidemiological studies. As part of its recent strategic planning activity, the NIEHS is placing a high priority on developing the exposome as a tool for discovery in the environmental health sciences. As part of our vision, we see a need for increased awareness of the concept of the exposome, the development of new technologies for multi-analyte exposure assessment and statistical approached, and the design of a definitive study to demonstrate the potential for uncovering unanticipated associations between environmental exposures and disease endpoints. Success of this demonstration project will not only generate new tools for subsequent studies and novel hypotheses for targeted validation efforts but will provide critical insight into the sources of important exposures to inform public health decision making.

Abstract Number	**S-2-32-05**
Presenter	Martine Vrijheid*
Exposure	others
Health domains	other
Type of research	health impact assessment

The Human Early Life Exposome (HELIX): Project Rationale and Design

Developmental periods in early life may be particularly vulnerable to impacts of environmental exposures. Human research on this topic has generally focused on single exposure-health effect relationships. A challenge is to broaden the range of exposures usually considered without increasing exposure misclassification. The Human Early Life Exposome (HELIX) project is a new collaborative research project funded under the European Commission's exposome programme. HELIX aims to 1) implement novel exposure assessment and biomarker methods to characterise early-life exposure to multiple environmental factors and 2) associate these with child health outcomes, thus characterizing the "Early-Life Exposome". In six existing prospective birth cohort studies in Europe, HELIX will estimate prenatal and postnatal exposure to a broad range of chemical and physical exposures: persistent and non-persistent organic chemicals, metals, pesticides, environmental tobacco smoke, water contaminants, air pollutants, noise, UV radiation, and contact with green spaces. Exposure models will be developed for the full cohorts totalling 32,000 mother-child pairs and biomarkers will be measured in a subset of 1,200. Nested repeat-sampling panel studies (N=150) will collect data on biomarker variability and use smartphone-linked sensors to assess individual mobility, physical activity and personal exposure to air pollutants and UV radiation. Omics techniques will determine molecular profiles (metabolome, proteome, transcriptome, epigenome) associated with exposures. Statistical methods for multiple and combined exposures will provide exposure-response estimates for fetal and child growth, obesity, neurodevelopment, and respiratory outcomes. Finally, a health impact assessment exercise will be conducted for combined early-life exposures. Helix is the first attempts to describe the early-life exposome of European populations and unravel ist relation to omics markers and health in childhood. It forms an important first step towards the life-course exposome.

Abstract Number	**S-2-35-01**
Presenter	Tim K. Takaro*, Huan Shu, Ryan W. Allen, Jeffrey Brook, Kathleen McLean, James Scott, Michael Brauer, Amanda Wheeler, Diana Lefebvre, Sheela Sathyanarayana, Malcolm R. Sears
Exposure	organic compounds
Health domains	allergies
Type of research	cohort study

Early life exposure to phthalates and immune response at one year of age in the Canadian Healthy Infant Longitudinal Development (CHILD) birth cohort

Phthalates are implicated as immune-modulators in animal and human diseases including asthma and allergy. The Canadian Healthy Infant Longitudinal Development (CHILD) birth cohort is a national study examining how the environment interacts with a child's genetics, immune system and other personal characteristics to cause these diseases. The 3,300 children in the cohort currently range from 6 mo. to 4 yrs. Comprehensive exposure assessment from mid-gestation through 5 yrs includes a home assessment, serum, urine and house-dust sampling, land-use regression model estimates of ambient air pollution and repeated questionnaires in multiple domains in an effort to estimate important exposures during key periods of development. Exposure questionnaire and home assessments were used to characterize potential sources of phthalate metabolite levels at age 3 mo. in the first 1,539 CHILD subjects. Seven phthalate metabolites were measured. The data suggest several potential sources of exposure including use of plastic food storage containers, home consumer products and moisture in the home. Preliminary analysis on the first 597 children with urinary phthalate metabolite measurements at both 3 and 12 mo. and allergy skin testing at 12 mo. suggests a role for DBP in the development of atopy. Logistic regression model results (uncorrected for co-variates) suggest that subjects who were in the highest quartile for urinary MBP concentration at both 3 mo. and 12 mo. have a higher risk of sensitization (defined as>=2 mm weal to>=1 allergen) compared to other subjects. Sensitization to a food allergen (OR=2.0, CI: 1.01-3.51); sensitization to any allergen (OR=1.75, CI: 1.00-2.97). No such relationship was found for the other 6 metabolites tested. This Canadian national birth cohort demonstrates ubiquitous phthalate exposures in the first months of life. Estimates of some phthalate exposure can be made using questionnaires about product use in the home environment. Due to the longitudinal nature of the exposure assessment we will be able to track these relationships over time. Preliminary analyses suggest a role for DBP in the development of atopy at one year, but these results need to be confirmed once data collection has finished.

Abstract Number	**S-2-35-02**
Presenter	Tina Kold Jensen*, Hanne Frederiksen, Tina Harmer Lassen, Katrine Tefre de Renzy-Martin, Jeppe Schultz Christensen, Katharina Main, Anne Maria Andersson, Flemming Nielsen, Steffen Husby, Henriette Boye Kyhl
Exposure	others
Health domains	other
Type of research	others

Exposure to endocrine disrupting chemicals and anogenital distance among Danish pregnant women

Background: In-utero and early-life exposures to endocrine-disrupting chemicals affect reproductive function. These include phthalates, phenols (incl. BPA), and fluorinated compounds used as plasticizers, solvents and lubricants in manufacturing of consumer products such as children's toys, medical equipment, cosme-tics, building materials, hard plastic, protective coatings of clothes, furniture, non-stick cookware and food packaging.

Methods: In The Odense Child Cohort pregnant women and their partners are offered participation when they show up for their first antenatal visit at their GP or for the first blood sample or ultrasound examination at Odense University Hospital in gestational weeks 10 to 16. The inclusion is expected to be from January 2010 - December 2012 and currently 2,478 families are included. A serum sample is collected at this point in time and the women respond to a comprehensive questionnaire about general health, lifestyle and social factors. When they return in gestational week 28, they deliver a urine sample and respond to another questionnaire about their pregnancy and complications. Details about the delivery are collected and cord blood stored. The children are clinically examined at 3 months of age and height, weight and skin folds measured. In addition, genital malformations are noted and anogenital distance (AGD) is measured. A blood sample from the child is obtained and the mothers respond to another questionnaire about the birth and the first 3 months of the child's life. For this study selected 500 serum and urine samples from pregnant women have been analysed for phthalates, BPA and other phenols and fluorinated compounds and will be related to AGD and congenital malformations in male reproductive tract.

Conclusion: We have measured chemicals in 500 pregnant women from the Odense Child Cohort and found detectable levels in almost all pregnant womenWe are currently associating these levels to AGD.

Abstract Number	**S-2-35-03**
Presenter	Shanna Swan*
Exposure	others
Health domains	reproductive outcomes
Type of research	cohort study

Linking prenatal EDC exposure to reproductive tract endpoints and neurodevelopment in two pregnancy cohort studies

Background: In 1999 NHANES began measuring phthalates and other nonpersistent pollutants in a representative sample of the US population. The development of the high-throughput sensitive assays necessary for this survey also made it possible to assess exposure of pregnant women (and the fetus) to a range of common contaminants that could not be previously examined. This technological advance made it possible to examine the developmental effects of chronic low-level environmental exposures and several large pregnancy cohort studies were designed to do this. Aims: 1) To describe two multi-center pregnancy cohort studies (the Study for Future Families, SFF and The Infant Development and the Environment Study, TIDES) in which we are studying associations between prenatal exposure to phthalates (and other chemicals and stressors) and genital development; 2) To describe the importance of animal models in identifying study endpoints and methods we are using to examine them. Methods: I will review the background of SFF and TIDES and the large resource we have established including cohorts for potential future follow-up, extensive questionnaire data on mothers, children and their families, and the archives of biological samples. I will also discuss how we learned from our experience in SFF in designing and conducting TIDES Conclusions: SFF and TIDES, together including data and samples on 1,200 mothers and over 1,000 children (ages 0-12 years), are important resources that we want to make available for collaborative research. This session should help facilitate such collaboration.

Abstract Number	**S-2-35-04**
Presenter	Pam Factor-Litvak*, Dror Mandel, Orly Stern, Rimona Keidar, Zachi Dagan, Joseph Tobvin, Whyatt Robin, Berkovitch Matitiahu, Lubetsky Ronit
Exposure	persistent organic pollutants
Health domains	reproductive outcomes
Type of research	cohort study

The Establishment of a Birth Cohort in Israel: the Environmental Health Fund Cohort Study.

Background: Brominated flame retardants and phthalates are ubiquitous contaminants in western populations. Exposure characterizations in pregnant women and associations with various outcomes in the offspring have been studied in several populations, including the US. These compounds have not been studied in pregnant women in Israel, where the population is multi-ethnic, and the routes of exposure and associations with outcomes may differ by ethnic group. Aims: The Environmental Health Fund Pregnancy (EHF) Cohort Study was developed to assess exposure to brominated flame retardants and phthalates in pregnant women in two hospitals in central Israel and to examine the associations between these contaminants and (a) pregnancy complications, (b) newborn anthropometrics, (c) ano-genital distance in newborns and (d) maternal and infant thyroid function. We are establishing an analytical laboratory to measure these compounds and establishing a bio-repository of maternal, paternal, and umbilical cord serum, maternal and paternal urine, meconium, and breast milk for future studies. Methods: The anticipated population characteristics of the EHF cohort will be described. Results from preliminary studies of the reliability of the anthropometrics and ano-genital distance measures will be given. The extensive questionnaires given to both parents will be described. We will also discuss establishment of the analytical chemistry laboratory and provide preliminary quality control data. Finally, we will describe the development of the biorepository. Conclusions: The EHF cohort will be an important resource for pregnancy studies of a wide range of contaminants in Israel. Ancillary studies will include evaluations of the associations between a wide range of social variables, and the interaction between social and environmental contaminants and outcomes. We anticipate instituting follow up studies of the children beginning at age 6 months and welcome collaborations.

Abstract Number	**S-2-35-05**
Presenter	Carl-Gustaf Bornehag*
Exposure	gene-environment interactions
Health domains	neurodevelopment
Type of research	cohort study

The SELMA study, a longitudinal study following 2,000 mother-child pairs from early pregnancy over birth and up in school age

All pregnant women in the county of Värmland, Sweden, were invited to attend the SELMA study at their first visit at an antenatal clinic in week 10 of the pregnancy. Almost 40% did accept to participate and about 2,500 pregnant women were recruited in February 2010. In the beginning of 2011, 2,094 children have been born into the study. The study provides an extensive dataset including biological samples stored in a biobank (urine/serum from 1st trimester, cord blood, urine form the child at 2 and 12 months of age), environmental samples stored frozen (air and dust from the home the during pregnancy and infancy period), questionnaire data from eight times (2 times during pregnancy and at 2, 6, 12, 18, 48 and 72 months of age of the child), and access to data from the routinely made health examinations of the children at the County Council of Värmland. The overall aim with the SELMA study is to examine the importance of prenatal exposure for endocrine disrupting chemicals (EDCs) for chronic diseases/disorder in offspring children (www.selmastudy.se). Four different health outcomes are focused on including (1) genital outcomes including anogenital distance (AGD) and puberty onset, (2) metabolic disorders including overweight and obesity, (3) immunological diseases including asthma and allergy, and (4) neurodevelopmental outcomes.We now have data on 1st trimester EDC metabolite exposure including phthalates (MEP, MBP, MBzP, MEHP, MEHHP, MEOHP, MECCP, 7OH-MMeOP, 7OXO-MMeOP, 7CX-MMeOP) and phenols (bisphenol A, troclosan) in urine and perfluorinated compounds (PFHxS, PFHpA, PFOA, PFOS, PFNA, PFDA, PFUnDA, PFDoDA) in serum for 2,356 women and we have thyroid hormones in cord blood for 1,516 births (T3, free T4, T4, TSH). We are now planning for an extensive health examination of the children at the age of 6 years to be started during 2014 for a period of 2 years.

Abstract Number	**S-2-37-01**
Presenter	Lieve Geerts*
Exposure	others
Health domains	no health domain
Type of research	exposure modeling

Conceptual model for dermal exposure to substances in articles

Background and aim: Assessment of dermal exposure substances in consumer articles is required in various regulatory frameworks. Existing dermal exposure modelling tools used for these purposes are designed and parameterized as screening tools and are therefore intended to be conservative in nature (e.g. consumer tool of ECETOC TRA, and ConsExpo). However, the tools are based on theoretical concepts that do not fully cover the complexity of dermal exposure processes, and as a consequence, tools generating realistic predictions of dermal exposure are lacking at the moment. The aim of this project is to develop strategies for realistic prediction of dermal exposure to substances in consumer articles. Methods and results: Hereto, a theoretical conceptual framework was developed, in which a variety of processes, compartments and pathways playing a role in consumer dermal exposure to substances in articles are described. Subsequently, this theoretical framework was applied on a few examples of articles (e.g. textile and PVC flooring) . Based on a extensive literature study, exposure determinants and its modifying factors playing a role in different processes from the conceptual model were identified, quantified (whenever feasible) and ranked in terms of their impact on dermal exposure, using semi-quantitative approaches. The result of this process will be shown for 2 categories of articles, namely textile and PVC flooring. Gaps in knowledge of key determinants for addressing dermal exposure to substances in those articles will be highlighted. A snapshot of experimental work (including consumer surveys) –ongoing in the CEFIC LRI funded DRESS project (http://www.cefic-lri.org/) – on these determinants will be given, along with approaches for validation of our realistic modelling approaches.

Abstract Number	**S-2-37-02**
Presenter	Koni Grob*
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Dermal uptake of bisphenol A from thermal printing paper

Background: On the printable side, thermal printer paper contains bisphenol A (BPA) at high concentration, i.e. touching the paper is similar to touching the pure chemical. Large amounts of BPA could be transferred to the skin, particularly compared to oral uptake. Aims: Measurement of the amount of BPA transferred from the paper to the skin and entering the skin to an extent that it can no longer be washed off. Methods: After touching the paper, fingers were extracted with ethanol. They were also extracted with a delay to determine the rate of BPA penetrating the skin to an extent to become non-extractable. Results: Roughly 1 µg BPA was transferred from the paper to a finger pad, depending on skin properties. It entered the skin at a rate depending on the type of contact. BPA applied as a solution in ethanol became non-extractable in less than 2 h. Dry contact caused slower or reduced uptake: 0.09 µg BPA entered per hour and finger pad, from which an uptake of some 70 µg per day was extrapolated for a person repeatedly in contact with thermal printing paper for 10 h/d. Conclusions: The experiments did not enable any conclusion on uptake into human metabolism. However, once the BPA can no longer be washed off, it is likely to accumulate in the skin and has almost unlimited time for deeper penetration. Current tests on transdermal uptake are limited to around a day, which might underestimate the time available in reality.

Abstract Number	**S-2-37-03**
Presenter	John Kissel*
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure measurement

Dermal uptake of chemicals

Biomonitoring has revealed the signatures of hundreds of chemicals in human blood and excreta. Prevention of exposures, which is central to environmental health policy and practice, requires that relevant routes and pathways be understood. Some existing studies that encompass both environmental and biological monitoring provide the opportunity to test aggregate exposure models. A frequent outcome is a shortfall between predicted dose based on environmental measurements and apparent dose estimated from biomarker data. One possible explanation for under-prediction of dermal dose is direct use of results of batch absorption experiments expressed as fractional availability. Because fractional availabilities obtained in this manner are routinely less than those observed via inhalation or ingestion, dermal exposure has often been discounted. However, low apparent availabilities may be an artifact of poorly designed or interpreted experiments. Even low rates of chemical uptake via the skin can account for a non-negligible fraction of a biomonitoring–based dose estimate if exposure is chronic and involves substantial skin area. Regulatory initiatives such as REACH have fostered demand for methods for systematic evaluation of human exposures to commercial chemicals, including many found in consumer products applied directly to the skin. Given prior experience, reconsideration of traditional approaches to assessment of dermal exposure is necessary. Dermal absorption is described as gradient driven transport through a membrane. Observed shortfalls in specific aggregate exposure case studies provide a basis for evaluating physical constants needed to characterize dermal dose. Overall mass transfer coefficients reflecting total resistance to transport from the environment to clothing, from clothing to skin, and from the skin surface to systemic circulation can be generated from these studies and compared to estimates derived from understanding of component processes. Once adequate cases have been developed, chemical screening capability will be improved.

Abstract Number	**S-2-37-04**
Presenter	Jacqueline Biesterbos, Gwendolyn Beckmann, Paul T.J. Scheepers*
Exposure	others
Health domains	other
Type of research	others

Method development and validation of breath analysis of cyclosiloxanes as a contribution to improvement of risk assessment strategies in the safety of personal care products

Background: Uptake of cyclosiloxanes from dermal use of personal care products (PCPs) can be estimated by analysis of exhaled air as a non-invasive approach in human biological monitoring. This method can be used to collect data to parameterize computer models and study aggregate exposures. Aim: Determination of the cyclosiloxanes octamethylcyclotetrasiloxane (D4) and decamethylcyclopentasiloxane (D5) in end-exhaled air to study skin absorption of PCPs. Methods:Four male and four female volunteers received an amount of 3.5 mg/cm2 (D5) or 3.2 mg/cm2 (crème or deodorant) applied to the forearm (700 cm2) for 60 minutes. Following exposure ten end-exhaled air samples were collected using a Bio-VOC breath sampler, transferred to carbograph multi-bed ATD tubes and analyzed by thermal desorption gas chromatography mass spectrometry (TD-GC-MS) using 13C-labelled D4 and D5 internal standards. The instrument is no source of siloxanes but the adsorbent tubes require pre-cleaning by high temperature purging prior to use. Reproducibility of the method is satisfactory with a variation coefficient of < 13% and a sensitivity of 0.7 ng/L for both substances. Inhalation uptake was minimized by keeping the forearm in a fume hood during exposure and by supplying fresh air to the breathing zone of the volunteer during the post-exposure period. Results: Preliminary results showed a fivefold increase of the baseline excretion of D5 when applying the neat substance and a twofold increase following application of the crème. Absorption from the crème appears to slow down elimination by a factor two. The contribution of inhaled D5 was monitored and gave a minor contribution to the total uptake. Conclusion: A sensitive method for the quantitative determination of D4 and D5 from exhaled air was developed. First results for D5 indicate slower kinetics, comparing the results from topically applied neat substance with those from D5 in a product matrix.

Abstract Number	**S-2-37-05**
Presenter	Eva Manova*
Exposure	organic compounds
Health domains	no health domain
Type of research	exposure modeling

Modelling human exposure to organic UV filters via personal care products

Background: Organic ultraviolet (UV) filters are primarily designed to absorb UV radiation and hence protect our skin against UV-induced damage. Apart from sunscreens, they are found in many other categories of dermally applied personal care products (PCPs). Some organic UV filters are suspected endocrine disruptors, like e.g. ethylhexyl methoxycinnamate (EHMC) and octocrylene (OCT) that have been recently detected in breast milk of Swiss mothers. Aims: In this study, we therefore estimate aggregate exposures to these UV filters that are found in multiple leave-on PCP categories (face cream, aftershave lotion/balm, hand cream, makeup foundation, lip care, lipstick, sunscreen), which are often concurrently used by the same consumer. Methods: We are using a dermal exposure model requiring PCP use and co-use patterns and UV filter concentration data as input variables. PCP use and co-use patterns were determined by a postal questionnaire in German-speaking Switzerland (1196 respondents), which included, for the first time in Europe, children below the age of 12, who may be more vulnerable to certain adverse effects attributed to endocrine disrupting compounds. UV filter concentrations, kept confidential in Switzerland, were measured in 116 PCPs that were frequently used by the survey respondents. Results: Overall, UV filter concentrations in PCPs applied regularly throughout the year are similar to those in sunscreens that are used for sun protection and hence applied only on selected days. For each respondent, the aggregate exposure is estimated by combining the self-reported PCP use patterns with the EHMC and OCT concentrations that had been measured for the self-reported products. Conclusions: Thus for each substance we can provide realistic distributions of exposure for both genders and across all age groups.

Abstract Number	**S-2-39-01**
Presenter	Atanu Sarkar*
Exposure	others
Health domains	other
Type of research	others

Agricultural practices, food production, food security and governance in South Asia

Background: South Asia, the most populous and densely populated geographical region in the world, has a long experience of famine. The introduction of high input modern agriculture, dependent on fossil fuels, made the region a net food exporter. However, South Asia still has the world's highest number of undernourished children, even more than in Sub-Saharan Africa. Aims: This study explores the development paradox of high agricultural growth and looming food insecurity in South Asia, in the context of nearing limits to growth. Methods: Literature review, supplemented by field based research, conducted in rural areas of India.Results: In South Asia, the dominant strategy of food production has assumed that the natural resource base (e.g. soil, energy, water) is effectively unlimited. Adverse ecological consequences and the concept of sustainability has received inadequate attention, resulting in worsening water shortage, salinity, toxic contamination, soil erosion, , and resurgent vector borne diseases. Growing tension over trans-boundary water between India and Pakistan could even lead to a nuclear confrontation. Public investment in agriculture research has also been low, for instance, in India only 0.5% of agricultural GDP compared to 2-3% in developed countries. Advanced crop technologies have been insufficiently complemented by supportive infrastructure, inadvertently contributing to thousands of suicides in farming communities. Safety net programs for the most vulnerable population have not delivered intended food security improvement; instead endemic problems including lack of accountability, and top down, opaque governance have worsened. Relatively high population growth has impaired development trajectories and also worsened nutritional inequality. Conclusions: Current agricultural and development policies are increasing nutritional inequalities in many parts of South Asia. The current paradigms are unsustainable and need major reform.

Abstract Number	**S-2-39-02**
Presenter	Phil Weinstein*
Exposure	others
Health domains	other
Type of research	others

Ecosystems, Biodiversity, and Limits to Growth

Background: Healthy ecosystems provide a variety of “services” to humans, most obviously provisioning (food, fuel, and shelter), but also regulating (climate control, disease suppression), cultural (recreation and inspiration) and supporting (soil fertility). But, like other elements of the Earth system, the supply of ecosystems and their services is finite.For millennia, humans have altered ecosystems, especially in ways which increase their provisioning function, but at the expense of their other services. Limits To Growth (LTG) include some of these conversion processes, the rate of which must be slowed, and then reversed, if humanity is to flourish sustainably. Concomitants of the erosion of ecosystem functionality and resilience include lost biodiversity, and, in some cases, epidemiological changes, including disease emergence.Aim: This paper argues that living within limits, including the retention of biodiversity, with a better understanding of the links between biodiversity and health, can ameliorate a wide variety of public health problems.Methods: Examples are gathered from the literature that demonstrate a quantifiable link between healthy ecosystems and healthy humans. Results: Recent public health problems, including Lyme disease, ciguatera fish poisoning, birth defects, and Ross River virus infection, can all be partially attributed, either directly or indirectly, to biodiversity loss and the erosion of ecosystem services that biodiversity provides. Biodiversity conservation therefore supports the suppression of disease in human populations, at least in some situations. With a better understanding of the relationship between ecosystem health and disease emergence, it would be possible to identify interventions that benefit both the environment and human health concurrently. To be sustainable, the success of such interventions ultimately depend on us living within LTG.Conclusion: Biodiversity conservation should be considered as a public health intervention. This is not because it is the role of biodiversity is to serve humans, but because human health is a powerful political ally for the conservation movement.

Abstract Number	**S-2-39-03**
Presenter	Tee L. Guidotti*
Exposure	others
Health domains	other
Type of research	others

Health and Sustainability: A Taxonomy of Relationships

A simple, general framework for understanding the relationship between ecosystem change and sustainability issues and their consequent health outcomes will advance understanding and simplify communication. The present work seeks to develop a taxonomy or typology for relationships between health and issues of sustainability, identifying fundamental principles for each type. These types should be understood as different ways of looking at problems, not mutually exclusive categories:- “Catastrophic failure”, characterized by existential risk for viability on a large scale because of effects beyond capacity to adapt or mitigate, and therefore are characterized by an “all or nothing” tipping point. (Global climate change.) -“Pollution issues”, characterized by exposure-response relationships for severity and frequency of response, follow principles of toxicology as applied to populations. (Such issues have been the core interest of ISEE and ISES from their beginnings.) -“Ecosystem change and stochastic disease risk” define a class of sustainability-health interactions in which ecosystems are destabilized and have indirect consequences mediated by biological mechanisms other than direct toxicity, expressed by increased frequency of disease. (Infectious disease risk and the conventional “public health triad”.) -“Ecosystem change and mediated health risk”, characterized by entropy and loss of access to resources or economic opportunity and mediated by social or economic mediation. (Health effects of unemployment after depletion of fishing stocks.) -“Degradation of environmental services” after cessation or diminution in natural functions of economic value that affect health. (Land use decisions that affect airsheds and water reuse.) “Urban ecosystem management problems”, characterized by inadequacy of management of artificial ecological systems in human communities. (Wastewater disposal.)

Abstract Number	**S-2-39-04**
Presenter	Colin Butler*
Exposure	others
Health domains	other
Type of research	others

Limits to growth and environmental epidemiology: a conceptual framework

Background: Environmental epidemiology (EE) strives to demonstrate and thus help reduce threats to human health arising from exposures in the physical environment. Since 1988, the conceptualisation of valid research topics, policy development and intervention options has expanded from the molecular to the planetary scale. Climate change is the principle example of an acknowledged planetary-scale threat relevant to EE, but is a part of an even larger, multidisciplinary problem, often called "Limits to Growth" (LTG). Aims: To introduce a conceptual framework to argue that LTG be considered a legitimate issue for EE research and intervention. Methods: A focused interdisciplinary literature review, undertaken over two decades, involving dynamic systems thinking and analysis was used to develop this framework. Results: LTG refers to complex inter-related environmental and social phenomena, including resource depletion and social responses to scarcity, that undermine and threaten the sustainability of our species. In recent years, scientific interest in LTG has revived, driven by rising global energy and food prices, conflict, and increasingly apparent flaws in the dominant economic system. To date, however, very few workers in the public health sciences have considered the relevance of these interlinked threats to global public health. This formidable issue is beyond the scope of any single discipline, including EE. Nevertheless, whether in isolation or with other disciplines, environmental epidemiologists may be able to better characterise this issue, and thus make a vital contribution to global health protection. Conclusions: Addressing LTG has the potential to prevent enormous harm to global public health, irrespective of whether environmental epidemiologists give it attention. There is a morally compelling opportunity to engage with these new challenges, which will require new epidemiological and transdisciplinary conceptualizations, methods, and collaborations.

Abstract Number	**S-2-39-05**
Presenter	Colin Soskolne*
Exposure	others
Health domains	other
Type of research	others

Scientific factors that obscure and obstruct our understanding of the limits to growth

Background: Tight connections exist between scientific methods and ethics, including for epidemiology. These range from permissible research questions to acceptable study dissemination. Epidemiology's mandate is to use science to inform policy in ways that protect health, well-being and, indeed, civilization. However, many powerful interests erode epidemiological capacity for this. Objectives: To review the literature on how scientific integrity may be compromised by powerful interests, and how professional organizations have attempted to counter this to defend the public interest. Well-known examples include tobacco, asbestos, chemical pollution, and climate change. Beyond these, might powerful interests obscure limits to growth, and thus exacerbate risks to civilization — and thus public health? Methods: Available literature exposing influences on science is reviewed, including oppression, suppression, and repression biases. The philosophical context for science to flourish through refutation serves as the basis for this analysis. Results: Since at least 1952, increasingly abundant evidence exists of influence, in both science and public policy, of the fomentation of doubt as an essential tool to hinder healthy policy. Strategies to influence government to delay tobacco reform policies have been extended to asbestos and cell phones, and also to deny climate change, population pressures, and increasing resource scarcity. These strategies include the erosion of academic freedom by the infiltration of university governance by moneyed interests. Conclusions: Global change requires impartial applied sciences, integrated over many disciplines, if solutions are to be found that move humanity from a path seemingly destined to collapse to one that can endure with equity and ecological integrity. Increased vigilance and transparency by journals, professional organizations and university boards are also essential if applied sciences are to effectively promote the public good.

Abstract Number	**S-2-39-06**
Presenter	Jouni Jaakkola*
Exposure	household air pollution
Health domains	other
Type of research	others

Sustainable Housing, Limits to Growth and Climate Change

Background: The overall scenario first presented in The Limits to Growth (Meadows et al. 1972) suggested that the mankind is consuming more than nature is capable of providing which threatens lead to global economic collapse with serious health consequences. The original models focused on remaining non-renewable resources, food production per capita, services per capita, industrial output per capita, population growth and production, but the roles of global pollution and climate change as limiting factors have gained increasing attention. Quality of housing is a central determinant of public health, but carbon footprint from housing is great (30-40%) both in cold climate where energy is consumed in heating, and warm climate where indoor climate is cooled mechanically.Aims: To consider housing and public health within a broad framework taking into account needs for public health, environment, climate change, and natural limits.Methods: Conceptual analysis of existing information and predictions on global environment and health. Results: Sustainable housing needs to balance between several limits to growth. The key for future planning and decision making is to consider the life-cycle of housing from the building phase, including production of raw materials, production of building materials, and construction to usage, including energy consumption, maintenance, service, repair, and renovation to deconstruction and recycling of materials. Different perspectives produce contradictory conclusions for needed action. For example substantial reduction in greenhouse gas emissions could be achieved by reducing building ventilation and heating, but health research provides evidence that this is likely to increase indoor pollution causing both short and long-term health effects. Conclusions: Systems analysis at the global level is necessary for development of sustainable housing which optimizes use of materials, energy consumption and public health needs. Multidisciplinary research within a global framework is critical to support policy and decision making.

Abstract Number	**S-2-42-01**
Presenter	Kerry Kinney*, Juan Pedro Maestre, Maria D. King, Alexandra Caya, Andrew Hoisington
Exposure	others
Health domains	other
Type of research	others

Characterization and Source Tracking of Bioaerosols in Residential Showers

Background: There is a growing recognition that showers represent a human exposure route to microorganisms. Waterborne microorganisms with health implications are found in tap water. Thus, bioaerosols produced in showers may be enriched in potential pathogens and allergens. Also, shower units provide a suitable habitat for microbial growth. To date, the microbial assemblages in aerosols generated in residential showers have not been fully studied. Aims: The objective of the study is to characterize the fungal and bacterial microbiome aerosolized during shower operation and to identify their potential sources within the shower system. Methods: Bioaerosols samples were collected from residential showers using a wetted wall cyclone. Samples of tap water and biofilm swabs of the showerhead and stall were also collected. One sample set was collected before the shower unit was cleaned and one set after. Microbial DNA from the samples was analyzed via pyrosequencing and qPCR targeting the bacterial 16S region and the fungal ITS region. Bioinformatics processing was conducted to determine phylogenetic trees and diversity indices to characterize and compare the sampled microbial assemblages. Results: Fungi and bacteria with potential health effects have been detected in the shower bioaerosol samples (e.g., Alternaria alternata and Burkholderia spp). The composition of the aerosolized fungal community changed when the shower unit was in use. Cleaning of the shower unit decreased the abundance of selected OTUs but not all. These results suggest that the source of the species not affected by the cleaning may be from the water distribution system itself. Conclusions: Microbial species with potential human health effects are found in shower bioaerosol samples representing a human exposure route that has not been considered until recently. On-going research is being conducted to correlate the aerosolized microbial assemblages with microbial reservoirs present in shower units.

Abstract Number	**S-2-42-02**
Presenter	Anne Hyvärinen*, Kati Järvi, Martin Täubel, Michael Sulyok, Juhani Pirinen, Tuula Syrjänen, Rudolf Krska, Riitta Patovirta, Aino Nevalainen
Exposure	others
Health domains	other
Type of research	others

Effect of renovation of moisture damage on microbial metabolites and occupants' health

Background: Moisture and mold damage affects negatively on the indoor air quality and has been linked with ill health, including increased risk of asthma, upper respiratory symptoms, and repeated infections. Aims: The aims of the study are to produce information on the occurrence of microbial metabolites in severely moisture damaged homes and to determine the effect of intervention on exposure and health effects. Methods: 11 of 45 homes with severe moisture damage have gone through the intervention of damage. Microbial metabolites were analyzed from building material samples and dust samples before and after intervention with LC-MS/MS-based analysis.The health status of the residents was assessed with symptom questionnaires repeated before and 3 month after intervention. Results: Residents of homes with more severe measured microbial growth in structures had significantly higher frequency of reported respiratory and general symptoms, compared to those living in homes with less severe microbial growth. After the intervention, statistically significant reduction in frequency especially of respiratory, eye and general symptoms, such as tiredness or headache, was observed. A large variety of fungal and bacterial secondary metabolites (n=48) were detected in building material and dust samples of homes before renovation, with concentrations ranging from low ng to high µg per g sample.In a small subset of homes with complete health and microbial metabolite information available from before and after intervention, changes in symptom score followed changes in metabolite load in floor dust. Conclusions: Mold renovation in formerly damaged homes leads to significant alleviation of the symptoms. A large variety of microbial toxins is detectable in indoor samples of moisture damaged homes. Indicative findings support the possible involvement of microbial toxins in observed adverse health effects; associations will be further explored in a more complete dataset.

Abstract Number	**S-2-42-03**
Presenter	Kerry Kinney*, Jeffrey A. Siegel, Juan Pedro Maestre, Andrew Hoisington
Exposure	others
Health domains	other
Type of research	others

Evaluation of Microbial Survival and DNA persistence in HVAC Filters

Background: Heating, ventilation and air conditioning (HVAC) filters remove both particulate matter and microorganisms from indoor environments. They thus can improve indoor air quality and also serve as a microbial reservoir for forensic studies. Recovering and analyzing the microbial community trapped within HVAC filter dust is a useful approach for delineating the indoor microbiome present in a wide variety of buildings including residential homes, commercial buildings and even retail stores. Aims: The objective of this study was to evaluate DNA recovery from HVAC filter dust under simulated HVAC operating conditions. Methods: HVAC filters with sterilized HVAC dust were spiked with known concentrations of Aspergillus niger and Bacillus cereus. The loaded HVAC filter dust was then subjected to air flow and relative humidity conditions typical of HVAC operation. DNA was extracted on days 0, 1, 4, 7, and 17 and cell counts were estimated via qPCR. Results: The results indicate that the specific filter dust type has an impact on DNA extraction efficiency, with 60% of the initially loaded cells recovered immediately following spiking from one filter and fewer than 20% recovered from the other. Generally, the DNA was recoverable within 7 days of inoculation even under the simulated airflow conditions. After 17 days of airflow, less than 5% of the spiked DNA was recoverable from the filter dust. Conclusions: The results of this study are important in applying HVAC filters as indoor microbial samplers for future investigations. The results suggest that filter dust inhibits DNA amplification to varying levels, suggesting that positive controls should be utilized to determine sample extraction efficiency. The data indicate that the DNA from the model organisms was recoverable after exposure to airflow for 7 days with minimal loss. However, additional exposure past seven days resulted in a considerable reduction in the DNA recovered.

Abstract Number	**S-2-42-04**
Presenter	Maria Nunez*
Exposure	others
Health domains	other
Type of research	others

Fungal specialists on insulated and non-insulated outer walls in basements

Background: Moist basements and crawl-spaces can result in the establishment of different microbial communities, depending on abiotic factors, and type of materials or constructions used. Below-grade microbial growth is a potential cause of negative health effects in residences, as released spores can find their way to the indoor air by the stack effect. Aims: By characterizing microbial communities in basements and crawl-spaces, we can address the causes of moisture damage, spot the source of spore spreading, and avoid future damage by improvingbuilding construction practices. Methods: We have collected samples in basements and crawl-spaces with moisture problems from 2001-2012. Both the substrate and construction type have been recorded in all cases. We have focused on four species of moulds (Ascotricha chartarum, Chrysosporium pannorum, Monocillium sp., and Myxotrichum chartarum) besides Actinomycetes, as these taxa grow preferably in rooms below grade. Statistical analyses were carried out with R software. Results: The species studied grow both in basements and crawl-spaces, and are good indicators of moist foundation walls. Growth in crawl-spaces occurs mainly in ceilings. All taxa are more common in basements compared to crawl-spaces.Myxotrichum chartarum is the most common species in crawl-spaces, while Actinomycetes dominate in basements. Each taxon has a strong preference for a type of substrate: Actinomycetes grow preferably on concrete, Ascotricha chartarum and Monocillium sp. on gypsum board, Chrysosporium pannorum on wood, and Monocillium sp. and Myxotrichum chartarum on air barriers. Conclusions:Niche colonization of these taxa can be explained on the basis of substrate preferences, but also on differences of RH and temperature throughout constructions. Avoiding certain construction practices in basements have prevented microbial growth and improved the residents' welfare in Scandinavia.

Abstract Number	**S-2-42-05**
Presenter	Tiina Reponen*
Exposure	others
Health domains	other
Type of research	others

Microbial exposure and asthma development in children

Background: The presence of visible moisture damage and mold has been associated with asthma and respiratory symptoms in children, but there is less evidence on the association between quantitatively measured mold and health outcomes. Aims: In the prospective Cincinnati Childhood Allergy and Air pollution study, the association between the incidence of asthma at age seven and microbial exposures at ages one and seven were assessed. Mold was assessed using both qualitative and quantitative methods. Methods:At ages one and seven, dust samples were collected from the child's home and analyzed for (1-3)-b-D-glucan, endotoxin, 36 mold species, and Streptomyces. Mold species were analyzed using the Mold Specific Quantitative Polymerase Chain Reaction (MQPCR) assay, and the Environmental Relative Moldiness Index (ERMI) was calculated. Based on visual inspections, homes were classified into three mold categories: no visible mold , some visible mold, and high visible mold. Wheezing was assessed by a quationnaire admistered to the parent during child's clinic visit at ages one, three, and seven. Asthma was defined by a combination of parental report of the child's asthma symptoms and the battery of objective tests conducted at the clinic at age seven. Results: Qualitatively assessed mold was associated with wheezing early in life (at age one: aOR=4.4, 95% CI=1.6-12.1; at age three: aOR=6.2, 95% CI=1.4-27.4). Mold measured using ERMI at child's age one was associated with asthma development at age seven (aOR=2.6, 95% CI=1.1-6.3). Inverse associations were observed for (1-3)-b-D-glucan and Streptomyces, whereas effect of endotoxin varied depending on other co-exposures, e.g., traffic pollution and presence of dogs. Conclusions: Early life microbial exposure to mold quantitatively measured by ERMI was shown to significantly increase the risk of asthma at age seven. Inverse associations were found with microbial exposures that seem to originate from outdoors.

Abstract Number	**S-2-42-06**
Presenter	Martin Täubel*, Michael Sulyok, Esmeralda Krop, Alicia Borras, Juha Pekkanen, Dick Heederik, Lennart Larsson, Jan-Paul Zock, Rudolf Krska, Anne Hyvärinen
Exposure	others
Health domains	other
Type of research	others

Microbial secondary metabolites in indoor environments

Background: Secondary metabolites produced by fungi and bacteria are part of a complex exposure situation in damp buildings and may contribute to adverse health outcomes in residents. Aims: To assess the occurrence of fungal and bacterial secondary metabolites in school buildings in relation to moisture damage and dampness and to explore their relevance in respiratory health. Methods: Settled dust samples (N=1390) were collected from schools in Spain, The Netherlands and Finland. School buildings were categorized as either 'index' or 'reference' based on observations of moisture damage, dampness and visible mould. Dust samples were analyzed for the presence of a wide variety of microbial secondary metabolites (>190) using mass-spectrometry based methods. Respiratory health questionnaire data from 645 teachers were used to explore associations of crude sum of concentrations of metabolites in dust versus respiratory symptoms. Results: Microbial secondary metabolites were detected in 55% of settled dust samples. 30 different metabolites were detected, with up to 10 compounds measurable from a single dust sample. We observed both, geographical and seasonal differences in indoor metabolite patterns. Higher numbers of metabolites at elevated levels were detected in index compared to reference school buildings, however, only few statistically significant differences were seen for the occurrence of individual compounds. Preliminary, crude analyses indicated a significant, dose-response association of microbial toxins in dust with nasal symptoms in teachers in Finland. Conclusions: Microbial secondary metabolites are common findings in school buildings. Moisture damage and dampness seem to somewhat increase levels of a number of those compounds, but it is evident that their indoor occurrence is also affected by outdoor sources. Associations of microbial toxin load in dust with respiratory symptoms in Finnish teachers will be further explored.

Abstract Number	**S-3-06-02**
Presenter	Tim S. Nawrot*
Exposure	ambient air pollution
Health domains	other
Type of research	cross-sectional study

Mitochondrial DNA content and DNA methylation in association with exposure to particulate air pollution during critical periods of in utero life

Background: Studies emphasize the importance of particulate matter (PM) in the formation of reactive oxygen species and inflammation. We hypothesized that these processes can influence mitochondrial function and methylation of the placenta and fetus. Methods: Relative mtDNA copy numbers (i.e., mtDNA content) were determined by real-time polymerase chain reaction and global DNA methylation by UPLC coupled with mass spectrometry (n=240). Multiple regression models were used to link mtDNA content / global DNA methylation and in utero exposure to PM10/NO2 over various time windows during pregnancy. Results: In multivariate-adjusted analysis, a 10-µg/m³ increase in PM10 exposure during the last month of pregnancy was associated with a 16.1% decrease [95% confidence interval (CI): –25.2, –6.0%,p = 0.003] in placental mtDNA content. The corresponding effect size for average PM10 exposure during the third trimester was 17.4% (95% CI: –31.8, –0.1%, p = 0.05). In contrast to the mitochondrial DNA copy number placental methylation was associated with exposure windows early in pregnancy. We observed a lower global placental methylation at birth of -1.53% (95% CI: -2.45, -0.23%, p = 0.0012) and -1.22 % (95% CI: -1.91, -0.52%, p = 0.0008) for each 5 µg/m³ higher PM2.5 exposure during the implantation stage and the post-implantation stage respectively. Conclusions: We observed a lower degree of global placental methylation in association with exposure to particulate air pollution in early pregnancy including exposures of the critical stages of implantation. Placental mitochondrial function as exemplified by the DNA copy number was decreased in association with exposures at the end of pregnancy.

Abstract Number	**S-3-06-03**
Presenter	Carrie V. Breton*
Exposure	ambient air pollution
Health domains	no health domain
Type of research	cross-sectional study

Current applications for DNA methylation using Infinium – challenges and rewards

Background: In environmental epidemiology, the question of whether epigenetic processes might mediate environmental health effects is an intriguing one. The advent of the Illumina Infinium HumanMethylation450 BeadChip (HM450), for the first time, enabled the environmental researcher to interrogate thousands of CpG loci at one time to investigate such questions. As with any new technology, however, the limitations of the instrument should not be ignored, nor should emerging technologies that might supersede or complement the old. Aims:The goal of this presentation is to present and discuss an overview of uses and limitations of the HM450 as applied to environmental epidemiology research. Methods/Results:We will present data illustrating the use of the HM450 in an investigation of the effects of prenatal PM2.5 exposure on DNA methylation in a sample of 240 newborn bloodspots. We will highlight the quality control steps taken to reduce background noise, remove erroneous loci, and address sample quality. We will also present a comparison of different analytic approaches, and their similarities and differences, and address the issue of multiple testing and scientific follow-up, particularly in the context of a screening tool that generates scientific hypotheses. Conclusion: We hope to foster discussion of the future utility of this platform in the context of emerging sequencing or other technologies.

Abstract Number	**S-3-06-03**
Presenter	Nicole Probst-Hensch*
Exposure	no exposure
Health domains	no health domain
Type of research	review

Teasing out causation in environmental epigenetics

Background: Epigenetic mechanisms are critical to many cellular processes and diseases. Environmental factors can induce such epigenetic aberrations, which are potential modifiable and reversible preventive and therapeutic targets. Aims: Epigenome-wide association studies are increasingly complimenting GWAS in order to improve understanding of environmental factors with causal health effects. But significant caveats must be considered. Methods and Results: GWAS can infer causality if heritable disease risks flow from DNA to downstream molecular events. Genetic variants are unique in being randomly assigned to germ cells and present in all cells from conception onwards. Despite these Mendelian Randomization principles, genetic associations studies failed to fundamentally improve causal understanding of environmental risks. A key challenge is that human diseases evolve from complex processes, involving epigenomes, transcriptomes, proteomes, metabolomes, and interactomes. Consideration of epigenetics harbours the potential to bring back to light hidden genetic signals masked by a complex interrelationship of genetic variation, downstream molecules, as well as macro- and microenvironment. Epigenetics can provide a causal link between a genetic risk variant and molecular signatures in diseased cells and refine risk estimates for disease entities. Yet, epigenetics faces challenges. Humans possess innumerable epigenomes, differing between cells and changing over time. Current epigenetic studies often rely on blood and other accessible biomaterial in the absence of evidence that this is valid for assessing tissue-specific processes. These and other challenges will be evidenced with specific results from the literature. Conclusions: To apply epigenetics towards causal inference new methods are needed for sophisticated network modeling. Refined disease phenotyping and exposure measurement, longitudinally collected data, and a sophisticated combination of easily accessible and tissue-specific biomaterial are essential to environmental epidemiology.

Abstract Number	**S-3-06-04**
Presenter	Andrea A Baccarelli*
Exposure	others
Health domains	other
Type of research	others

Beyond DNA methylation: investigating histone modifications and miRNAs in epidemiology studies

Background: Interest in epigenetic phenomena has dramatically intensified over the last two decades with an exponential increase in PubMed-indexed publications from fewer than 150 in 1990 to over 13,000 in 2011. Publically available data from the NIH RePORTER reveal that the U.S. National Institutes of Health will spend over $700 million (2.8% of their total costs) on epigenetics in 2012. NIH-wide the National Institute of Environmental Health Sciences is one of the top two Institutes in proportion of overall spending on epigenetic projects – second only to the National Human Genome Research Institute (NIEHS's 7.1% vs. NHGRI's 8.0%). Methods/Results: Despite this surge, human environmental studies, thus far, have typically focused on DNA methylation as an easy-to-measure epigenetic mark with well-established function. The ease of preserving, storing and transporting DNA compared to the more care-intensive approaches to RNA and chromatin makes DNA methylation the least costly analytic approach. However, recent advances in molecular biology have opened new paths toward the integration of other epigenetic analyses into epidemiology and environmental health studies. This presentation will provide examples from recent environmental health studies on miRNAs and histone modifications. Emerging opportunities and tools, as well as potential challenges, will be highlighted and discussed. Conclusions: Prospects for future large scale environmental health studies will be outlined.

Abstract Number	**S-3-07-01**
Presenter	Kristie Ebi*
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	review

Bridging the North and South: climate science and practice

Background: The health risks of climate change are a consequence of the interactions of a changing climate with the specific regions and peoples exposed to those changes, and their susceptibility and response capacity. A wide range of data and tools are available to explore the possible magnitude and extent of possible impacts under different assumptions of future socioeconomic development and greenhouse gas emissions pathways, and to inform adaptation activities. Methods: Data and tools for understanding current and future climate hazards, exposure, and vulnerability include: · National and international meteorological services provide data on weather and climate variability. · Exposure maps, such as storm surge or vector distribution maps under current and future weather patterns, help identify regions and populations more likely to be exposed to potentially conditions or situations that could increase the burden of climate-sensitive health outcomes. · Public health and disaster risk management programs can use vulnerability mapping of sub-groups and studies to identify susceptible groups to more effectively target those most at risk of adverse health outcomes. Program evaluation can identify where and how response capacity can be improved. Results: National and local adaptation assessments use information on climate, exposure, and hazards to identify modification of current and implementation of new policies and measures to address current and projected health impacts. Challenges with using these data and tools include the mis-match between the time scale of climate projections and the time scale of interest for decision makers (often a decade or less), and the limited projections for factors that underlie vulnerability, such as the roles of institutions and governance. For many climate-sensitive health outcomes, countries in the South have more experience with managing risks that may emerge or re-emerge in the North, because of current health burdens and also because of longer experience with adaptation. Sharing experiences between the North and South on the key components of health risks and approaches to their management will facilitate effective and efficient adaptation.

Abstract Number	**S-3-07-02**
Presenter	Jan Semenza*
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	others

Data applications for state of the art analysis of infectious diseases

Background: Climate change manifests itself through a number of different impacts, including a shift in the distribution of vector-borne diseases. Food- and waterborne diseases (FWD) are also susceptible to clime change because dispersion, transport, fate and environmental exposure pathways are linked to climate. Aims: These challenges call for new tools and early warning systems for a better understanding of climate change impacts on infectious diseases in order to adequately respond to these challenges. Methods: 1) A knowledgebase of data from the peer-reviewed has been constructed to extract documented relationships between climatic drivers and FWD. 2) A software package for quantitative microbial risk assessment (QMRA) for FWD has been developed to quantify risk associated with changes in local climate; and 3) an early warning system has been built for selected vector-borne diseases. Results: 1) Information (key facts) from 6 pathogens was extracted from 722 peer-reviewed publications, entered into an electronic knowledgebase and analysed according climatic variables. 2) The QMRA tool computes risk for twelve pathogen-pathways for current location-specific climate conditions, projected climate, or specific conditions, depending on the selected modules. 3) An early warning system for tick-borne encephalitis in the southern part of Sweden has been built to estimate the risk for infection with cumulative spring temperatures. The system has also been used to describe the environmental suitability of the current malaria transmission in Greece. Conclusions: Results from these tools can now be incorporated into a handbook for vulnerability, impact and adaptation assessments to help local decision makers to identify potential vulnerabilities and inform public health adaptation programs how to strategically leverage existing strengths and mitigate future weaknesses of health systems.

Abstract Number	**S-3-07-03**
Presenter	Madeleine Thomson*
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	others

Early warning systems for infectious disease in the context of climate change adaptation

Background: Public health policymakers and practitioners are increasingly concerned about the potential impact of climate as well as environmental and social changes on the effectiveness of current and future infectious disease control and elimination programs. Climate change adaptation program are increasing in scope and resourcing. However, surprisingly, many control programmes of climate sensitive diseases and much of climate change adaptation is not informed by grounded knowledge and information on the climate at appropriate space and time scales.

Climate information has the potential to inform a wide range of health decisions and climate-informed early warning systems are increasing prioritized as a bridge between current disease control and future climate change adaptation needs. Here we discuss the experience of the International Research Institute for Climate and Society (a WHO Collaborating Center for Malaria Early Warning and other Climate Sensitive diseases) in the development and implementation of early warning systems in Africa – with a focus on malaria and meningococcal meningitis.

Aim: Compare and contrast the development of early warning systems for malaria and meningococcal meningitis in Africa.

Methods: Use a applied systems approach to understand the needs of a broad stakeholder community for the development early warning systems.

Results: Early warning systems for malaria are relatively advanced and accepted by stakeholders but challenges remain related to appropriate time-space scales for decision-making and ensuring that early warning is tied to response. Early warning systems for meningococcal meningitis are under development. An understanding of the underlying mechanisms whereby climate/environment drives epidemic disease is essential to ensure the scientific basis for the early warning system as well as political buy-in.

Conclusion: The problems we seek to address are complex. Not only is there a need for new knowledge through targeted research there is a need to translate this knowledge to practical action in affected countries. To address the latter, a robust body of evidence must be presented indicating the value of climate-informed early warning systems to decision-makers, a community of practitioners must be mobilsed, and empowered to use the information and the means to monitor and evaluate progress must be established.

Abstract Number	**S-3-07-04**
Presenter	Qiyong Liu*
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	cross-sectional study

Research on climate, climate change and vector borne diseases in China

Vector-borne diseases, transmitted by the bite of infected arthropod species, remain a serious public health threat and have become a great burden on economy and society in the world. China has experienced considerable changes in climate over the last decade. The potential impact of climate change on transmission of vector-borne diseases poses a threat to the Chinese people. Plague is a deadly infectious disease and the third plague pandemic is believed to have originated in China. Using the spatial and temporal human plague records in China from 1850 to 1964, it was found that the associations between human plague intensity and precipitation are nonlinear: positive in dry conditions, but negative in wet conditions. Based on long-term epidemiological data (1772-1964) of Chinese plague foci, the plague was found in diverse environments using a clustering method and an ecological niche model. Concerns regarding the impact of global warming on vector–borne diseases have intensified interest in the relationship between temperature and Dengue Fever (DF) incidence. With climate warming, the distribution of Ae. albopictus would expand its geographic limit and the potential transmission of dengue fever would increase, using GIS and CLIMAX model analysis. Minimum temperature and wind velocity are significant predictors of dengue incidence in Guangzhou, China for the period of 2001-2006. Climate change will increase the opportunities for malaria transmission in traditionally malarious areas, in areas the disease has been controlled, as well as in new areas. Time series analysis, GEE and GIS were conducted to analyze the association between climatic factors and the yearly incidence of malaria in Yongcheng city. Significant factors contributing to malaria incidence were maximum temperature at one month lag, average humidity at one month lag, and malaria incidence of the previous month. In China, the monthly trends of HFRS were significantly associated with local temperature, relative humidity, precipitation, air pressure, and wind velocity of the different previous months using principal components regression model. In addition, the ARIMA model was found to be a very useful tool for forecasting the incidence of HFRS in recent years.

Abstract Number	**S-3-13-01**
Presenter	David Holstius*, Virginia Teige, Katja Weichsel, Holly Maness, Andrew Hooker, Edmund Seto, Ronald Cohen
Exposure	ambient air pollution
Health domains	policy
Type of research	exposure modeling

A fine-scale, multi-stakeholder, multi-pollutant ambient monitoring network for understanding urban metabolism and population exposure

Modern air quality sensors are facilitating the deployment and operation of spatially dense ambient monitoring networks at increasingly fine scales. Estimates and observations from such networks are uniquely valuable to scientists and regulators concerned with improving atmospheric models, emission inventories, and forecasting tools. They are also of value to local and regional health and planning professionals concerned with population exposures, healthy infill development, screening of candidate sites for regulatory monitoring, and timely verification of policy interventions. In the San Francisco Bay Area, regional policies targeting climate change mitigation through sustainable land use and transportation initiatives motivate the combined monitoring of greenhouse gas and traffic-related criteria air pollutants at fine scale. Within this context, we report on the BEACON network, a lattice of 30 fixed-site monitoring stations located approximately 2 km apart in Berkeley and Oakland, California. Individually, measurements from BEACON monitors are of moderate quality, but when taken together can produce an accurate, highly resolved picture of real-time atmospheric concentrations. Initial work has focused on sampling CO2 concentrations using laboratory-calibrated, research-grade instruments, as well as collecting and validating measurements from NO2, O3, and CO sensors. Validated BEACON data is freely available to all stakeholders, including the general public, through a website that offers tools for visualizing, browsing, and downloading data (http://beacon.berkeley.edu). BEACON offers lessons in leveraging community partnerships for staging and operating such a fine-scale network, selecting sensors for particular purposes, and conducting outreach and curriculum development with educators, community groups, and citizen scientists. These lessons may be relevant to the design and deployment of next-generation air monitoring infrastructure in additional locales.

Abstract Number	**S-3-13-02**
Presenter	Alena Bartonova*, CITI-SENSE consortium http://www.citi-sense.eu
Exposure	ambient air pollution
Health domains	no health domain
Type of research	others

CITI-SENSE: Can sensor technologies contribute to raising awareness of environmental health?

Background: Atmospheric monitoring enjoys a large boom of methods based on sensor technologies, used in portable and static devices that can be deployed in larger quantities. This presents an opportunity to equip the members of general public with easy-to-use devices. But it also presents a new set of challenges. This is investigated in CITI-SENSE, ”Development of sensor based Citizen’s Observatories for better life quality in cities”, a 4-year project co-funded from FP7 contract nr. 308524, started in October 2012. Aim: CITI-SENSE wants to develop useful environmental information products that would be based on data generated by citizens using sensor technologies, supplemented with other environmental and personal information, linked through widely compatible information technology platforms. As a secondary aim, we would like to demonstrate the usefulness of the information and the technologies to empower citizens for effective environmental governance, as well as their usefulness as contributors to scientifically valid exposure information. Method: The project joins three elements: technological platforms for distributed monitoring, information and communication technologies compatible with global observing systems, and societal involvement. Pilot case studies are focusing on urban air quality, public spaces and indoor environment at schools. Attention is given to participation of citizens and other stakeholders. Results: Pilot studies are carried out in nine European cities, and first examples are generating information. Conclusion: To date, the technological challenge, while important and often restricting, seems to be solvable. The societal involvement, however, lacks methodologies and approaches that would enable wider public participation. In epidemiological studies, enrolment of subjects follows protocols and can be controlled. In real life, the social aspects of the citizen’s observatories are determining the outcomes.

Abstract Number	**S-3-13-03**
Presenter	Radim Sram*, Pavel Rosssner, Jr., Andrea Rossnerova, Vlasta Svecova, Jan Topinka
Exposure	ambient air pollution
Health domains	healthrelated quality of life
Type of research	exposure measurement

CITI-SENSE: Ostrava, Czech Republic – European hot spot for ambient air exposure to benzo[a]pyrene

Background: The Ostrava Region in the Czech Republic is a heavily polluted industrial area. Concentrations of PM10, PM2.5 and of benzo[a]pyrene (B[a]P) significantly exceed limit values. Our previous studies suggest that environmental exposure to B[a]P represents a risk of DNA damage and oxidative stress, increased respiratory morbidity in preschool children and the different molecular phenotype of asthma bronchiale in children. Aim: To use sensor technologies to understand the impact of different sources to a total air pollution (industry, local heating, traffic). Method: Volunteers from the most polluted part of city – Ostrava-Radvanice will use personal monitors for PM2.5 and c-PAHs, DNA damage will be determined as micronuclei, oxidative damage to DNA as 8-oxodG, lipid peroxidation as 15-F2t-IsoP. Simultaneously will be collected HiVol-samples to determine PM2.5 and c-PAHs. In the same location will be established network of sensors for selected pollutants. Results: Pilot study will generate information about the use of sensors to indicate significant air pollutants, possible sources of air pollution, and the interpretation of data using new technology platforms for the benefit of citizens. Important outcome will be about a possible relationship between biomarkers of DNA and oxidative damage and exposure assessment using sensor technologies. Conclusion: The expected outcome should be a new knowledge about the use of sensors in epidemiological studies to better characterize the exposure of citizens to air pollutants. Supported by CITI-SENSE, EU FP7-ENV-2012 (# 308524).

Abstract Number	**S-3-13-04**
Presenter	Emily Snyder, Paul Solomon, Ronald Williams*, Eben Thoma, Dena Vallano
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Low Cost Sensors - Current Capabilities and Gaps

New technologies and architectures for sensing criteria pollutants, air toxics, physical and chemical components of particulate matter, and greenhouse gases are emerging. These, so called, “sensor technologies” are generally designed to be mass-fabricated through innovative processes (e.g., microfabrication) and are: 1) small, 2) able to autonomously and continuously read pollutant levels, 3) designed to provide data in near-real time through wireless networks, 4) have low power consumption, and 5) support flexible deployment options (e.g., wearable sensors). These traits translate to reduced total cost of ownership, enabling both a higher spatial density and temporal frequency of air pollution measurements thus allowing personal exposure applications to be considered. Low cost portable air pollution sensors can potentially provide more location-specific and temporally resolved information desired by individuals and communities. Application of these sensors at the personal and microscale level also will greatly improve exposure estimates needed to better link air pollution to adverse health effects. Another application is the use of portable sensors to monitor indicator pollutants or classes of pollutants, like methane and total volatile organic compounds, as well as nuisance pollutants, like hydrogen sulfide and ammonia, which indicate the presence of pollution sources. Current technologies for portable air gas sensors include: electrochemical, metal oxide, spectroscopic, ionization, and pellistor sensors. Current technologies for portable particle sensors include: light scattering, light absorption, and those based on a change in frequency of an oscillating impaction surface (e.g. micro cantilevers). Attributes that indicate the appropriateness of these technologies for sensing air pollutants will be discussed, including: estimated range of measurement, selectivity (when applicable), appropriate deployment platforms, response and recovery time, power requirements or battery lifetime, and expected range of acceptable operating conditions.

Abstract Number	**S-3-13-05**
Presenter	Michel Gerboles*, Laurent Spinelle
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	exposure measurement

Use and evaluation of low cost sensors for the monitoring of NO2 and O3 in ambient air within the EURAMET MACPoll project

Metrology for chemical pollutants in air (MACPoll) is a EURAMET joint research project. It is divided into four work packages: NO2 and SO2 calibration zero gas (WP2) and span (WP1) at low concentration levels; development of reference methods/materials for semi-VOC in indoor air (WP3) and development/validation of micro-sensors (WP4). The aim of WP4 includes developing new graphene NO2 sensors and a standardized evaluation protocol for gas sensors, running an extended validation for the graphene sensor and other commercial sensors and finally grouping available gas sensors into a clustered system. The first task of WP4 included a review of the state of the art of gas sensors. The review considered NO2 graphene sensors and commercially available micro-sensors including solid state sensors, electrochemical sensors and miniaturised spectroscopic sensors for NO/NO2/NOx, O3, SO2, CO and benzene.The second task consisted in the production of two graphene sensors with enhanced sensitivity on both exfoliated graphene and epitaxial graphene.In the third task of the project, currently on-going, a protocol for the evaluation of gas sensor is developed and testing of performances of NO2 and O3 sensors is carried out. Based on the review, the graphene sensors and a set of commercial sensor were selected. Tests took place in laboratory in exposure chamber and at one field site. A large automated exposure chamber specialized for gas sensor test was developed.The aim of the final task of WP4, that will take place next year, is to cluster single sensors to a performing system able to detect NO/NO2/NOx, CO, SO2, O3 and benzene, the gaseous compounds that are regulated in the European air quality Directive. The protocol for evaluating sensors has been developed. It involves detecting significant parameters of the sensors (e.g. response time, drift, hysteresis, gaseous/physical/meteorological interference…) that are used to establish an empirical model describing sensors responses. Subsequently, the suitability of the model is tested under field conditions. This protocol was applied to 11 models of O3 sensors. It is now applied to 7 models of NO2 sensors. Data treatment is going-on in order to prepare evaluation reports for all sensors.

Abstract Number	**S-3-19-01**
Presenter	Kalpana Balakrishnan*, Suresh Dhaniyala, Santu Ghosh, Sankar Sambandam, Krishnendu Mukhopadhyay, Nigel Bruce, Kirk R. Smith
Exposure	ambient air pollution
Health domains	other
Type of research	health impact assessment

Application of the WHO air quality guidelines to address ambient air pollution exposures in India: The need to address outdoor and household sources

Background: The global update of the WHO air quality guidelines in 2005, steered by the WHO Division of Air Quality and Health in Bonn provided for the first time, interim and guideline targets for specific criteria air pollutants. These allowed many developing countries, including India to benchmark their own national air quality standards against the interim targets and develop plans to reach guideline values in the long-term. Aim: To highlight special considerations in the application of the WHO air quality guidelines to address ambient air pollution exposures from outdoor and household sources in India. Methods: We provide an overview of the ambient air quality status in India from a comprehensive literature review and the data from the nearly 350 monitoring urban air quality monitoring stations being operated by the Central Pollution Control Board, Govt. of India. We also track important new emission and fuel quality related legislations brought forth to comply with the newly revised national ambient air quality standards, that in turn were driven by the WHO-air quality guidelines. We also provide results from a small number of studies that provide empirical or modeled estimates for contributions from household fuel use to ambient air pollution (primarily) in rural India. Results & Conclusion: The new estimates for the burden of disease attributable to ambient air pollution in India includes contributions from outdoor and household sources, but air quality regulation in India is perceived to be limited to urban cities The use of the WHO air quality guidelines affords a unique opportunity to include urban and rural air quality under the ambit of existing standards. We highlight the need to initiate intervention efforts beyond vehicular and industrial emission reductions and to include household cookfuel sector interventions to make substantive progress towards achieving air quality standards described by WHO AQGs in India.

Abstract Number	**S-3-19-02**
Presenter	Michael Brauer*, x x
Exposure	ambient air pollution
Health domains	policy
Type of research	health impact assessment

Global perspectives in outdoor air pollution: Burden and prospects

Background: Despite substantial reductions in air pollution concentrations in North America and Europe, air pollution remains a concern throughout much of the world, especially in rapidly developing economies. Methods: In the context of the Global Burden of Disease 2010, annual average (for 1990, 2005 and 2010) concentrations of ambient PM2.5 and ozone were estimated at 0.1° x 0.1° spatial resolution and linked to high-resolution population density data. These estimates allow for an unprecedented examination of global disease burden attributable to ambient air pollution and analyses of population exposure, including both urban and non-urban populations. Results: Ambient PM2.5 is estimated to be responsible for 3.2 million deaths/yr and 3.1% of global disability-adjusted life years (DALYs) via ischemic heart disease, chronic obstructive pulmonary disease (COPD), lung cancer, stroke and acute lower respiratory tract infections. Ambient ozone exposure pollution contributes an additional 150,000 deaths/yr via COPD. Exposure estimates suggest a ~8% increase in global population-weighted PM2.5 concentrations, with relatively small changes in the absolute attributable disease burden between 1990 and 2010 (1990:82 million DALYs, 2.9 million deaths/yr; 2010: 76 million DALYs, 3.2 million deaths/yr). 86% of the 2010 burden is accounted for by developing countries (with China, India and Southeast Asia alone contributing over 60%). Conclusions: Even with stabilization or decreases in air pollution concentrations in rapidly developing economies, the increasing size of their susceptible exposed population due to demographic and epidemiologic transitions and urbanization suggests challenges in reducing this disease burden in the future. Further, while experience from developed countries indicates that air quality management efforts are very cost effective, recent evidence suggesting non-linear concentration-response relationships implies that achieving large benefits from air pollution reduction in polluted settings will requires large improvements in air quality.

Abstract Number	**S-3-19-03**
Presenter	Dan Greenbaum*
Exposure	ambient air pollution
Health domains	policy
Type of research	review

The USA outlook on outdoor air pollution – from science to regulation

The USA outlook on outdoor air pollution – from science to regulation Presenter: Dan Greenbaum, Health Effects Institute, USA;dgreenbaum@healtheffects.org Since the passage of the US Clean Air Act Amendments of 1970, the United States Environmental Protection Agency (EPA) has had the responsibility to review, each five years, the then-available scientific evidence on exposure to and health effects of several major air pollutants, and to determine at what level to set National Ambient Air Quality Standards (NAAQS) in order to “protect public health with an adequate margin of safety.” The EPA and state governments are then legally responsible to implement rules to reduce emissions of those pollutants in order to meet the NAAQS limits. Over the past 40 years, these scientific reviews have resulted in sequential lowering of the levels of the NAAQS, and the implementation of stringent control measures that have significantly reduced exposure to carbon monoxide, ozone, and particulate matter air pollution, among many others. This presentation will draw upon a systematic review of the use of epidemiologic evidence in this process (Greenbaum 2001), and the recent Integrated Science Assessments (ISAs) of the EPA, to discuss how evolving science has been applied to support both the setting of the NAAQS levels and the promulgation of regulations for diesel emissions, electric power plants, and other major sources. Special attention will be paid to the recent application of systematic criteria for determining causality in the preparation of the ISAs (Stanek 2010), and the role that evidence played in the often-controversial decisions. “Particulate Air Pollution Standards and Morbidity and Mortality: A Case Study,” Greenbaum DS, Bachmann JD, Krewski D, Samet JM, White R, Wyzga RE, , Supplement, Volume 154, No. 12, American Journal of Epidemiology, 2001 “A Review of the PM Science for Health Effects,” Stanek LW, Sacks J, Dutton S, and Ross M, EM, September 2010, www.awma.org

Abstract Number	**S-3-19-04**
Presenter	Bert Brunekreef*
Exposure	ambient air pollution
Health domains	policy
Type of research	review

6.2 Key new findings on health effects of air pollutants and impact of evidence for EU policies and WHO guidelines – the REVIHAAP and HRAPIE Projects

The REVIHAAP project was co-funded by the EU DG ENVIRONMENT and WHO Regional Office for Europe, to answer a set of 26 specific questions about air pollution and health. The EU designated 2013 to be 'Year of Air' during which a comprehensive review of the air quality policies will be undertaken. Questions asked to WHO centered on the health effects of the pollutants covered under the EU Air Quality Directives, with a particular focus on Particulate Matter, Ozone and Nitrogen Dioxide. WHO last established Air Quality Guidelines (AQG) in 2005, and REVIHAAP considered whether these would need to be revised in the light of new research findings that became available since then. For Particulate Matter, it was concluded that the scientific basis of the AQGs was considerably stronger now, with some evidence emerging of serious mortality effects occurring at PM2.5 levels below the annul mean AQG of 10 microgram/m3. For ozone, evidence is emerging of effects of long-term exposure on respiratory mortality. This would strongly increase health impacts of ozone, which in the 2005 AQG documents were still thought to be restricted to short-term effects. For Nitrogen Dioxide, REVIHAAP focused on evidence of short-term and long-term effects of NO2 which were independent of effects of particulate matter . For short-term effects on mortality and hospital admissions, there is now considerable evidence of independent NO2 effects. For long-term effects, similar evidence is emerging, although it remains difficult to separate NO2 effects from those of other traffic-related components. At the moment of abstract submission, the new air quality policies are still under review, and the influence of the REVIHAAP findings on this cannot yet be gauged.

Abstract Number	**S-3-20-01**
Presenter	John D. Spengler*
Exposure	others
Health domains	other
Type of research	others

Climate change, Indoor Environment, and Health: Issues and Opportunities for Exposure science and Epidemiology

Each season the earth's weather offers more examples of how it responds to imbalances in heat and moisture. 2012 was the hottest year on record; Hurricane Sandy's devastation will cost billions of dollars; desert dust casts a pall over cities; and crops wither in searing heat and drought. Until recently, climate scientists dominated the discussions. Now it is recognized that climate change elements can affect conditions inside our buildings, bearing on our health. Further, as we implement energy reduction strategies to adapt to changes we run the risk of modifying indoor environments is such a way as to increase health risks. When focusing on climate change and indoor environmental quality, a traditional framework is useful to consider influences on materials and products, building characteristics that affect ventilation and moisture, and occupant behaviors and vulnerabilities. Health risks from indoor dampness and mold are well established. In the aftermath of severe storms and intense precipitation, more structures experience flooding, followed by increases in asthma and allergenic disorders. With increasing atmospheric CO2, ragweed pollen production increases. Increased electrical outages (storm and heat-related) have led to more cases of accidental CO poisoning from improper auxiliary generator use. The survival of viruses on surfaces is influenced by temperature and humidity. Absolute humidity is the controlling factor in the inactivation and transmission of influenza virus. While some regions will get warmer and more humid, reducing the chance of some viruses surviving on surfaces, other regions will become drier. The interactions among climate change factors, the built environment and human responses will be complex. Some elements of these interactions may be anticipated from ones we already recognize. But for some risks it will take long-term surveillance of weatherization programs, aging of new materials, and follow up on catastrophic events to reveal the consequence on our indoor environments.

Abstract Number	**S-3-20-02**
Presenter	Kirk R. Smith*, Tord Kjellstrom, Vidhya Venugopal, Bruno Lemke, Rebekah Lucas
Exposure	others
Health domains	other
Type of research	others

Indoor Climate Implications of Extreme Outdoor Climates

Background: Consensus climate modelling projects highly altered climates by 2100 with small but not low probabilities of reaching 6-9 deg mean annual increases in mean global temperature and much larger increases in some regions and seasons. Such temperatures imply increasingly large increases in areas where outdoor work is restricted because of physiological limits due to the local wet bulb globe temperature (WBGT), a function mainly of temperature and humidity, but also considering wind and radiation. A growing literature examines the implications for labour productivity in agriculture, construction, and other outdoor activities over time Aim: Here we examine the potential implications for indoor environments of a world in which outdoor work is increasingly difficult and, eventually perhaps, even impossible in some areas. Methods: We briefly review the existing literature on climate projections, the calculation of WBGT, and implications of extreme WBGTs for work productivity. We review also the implications for indoor work environments and energy demand of increasing demand for air conditioned workplaces as well as households. We calculate monthly indoor heat exposure situations in India, as an example, and discuss global implications. Results: We discuss implications for urban design, patterns of pollution exposures, physical activity for transport and recreation, and work practices in a world in which the human experience is increasingly confined to indoor environments. The effects are not only experienced outdoors as modelling shows seriously increasing indoor heat problems during lengthy periods each year and substantial increases in energy requirements for cooling to avoid serious health impacts and maintain productivity.

Abstract Number	**S-3-20-03**
Presenter	Yuguo Li*
Exposure	others
Health domains	other
Type of research	others

Urban warming and its impact on indoor environment

Background: Urban warming with 2-3oC increase in the last 100 years has been observed in many megacities, much faster than the average global warming rate. Aims: Our aims are to identify the effects of the major contributing parameters affecting this urban warming trend, and understand its impact on indoor air environment. Methods: We analyze changes in the characteristics of the daily temperature cycles in major cities in the world and develop a theoretical urban heating model to analyze contributing parameters. Results: We found a shift from 1:00 to 2:30 pm in the timing of the daily max air temperature in Hong Kong over the past 100 years, while there is only a negligible minor change in the phase of the annual air temperature cycle. The same trend exists in most other megacities. This finding suggests that since most man-made structures/surfaces are less than 1 m thick/deep, they will have a greater impact on the daily cycle than annual cycle. This hypothesis is confirmed by our simple urban heat balance model. Expected impacts on indoor environment include changes in outdoor thermal comfort, increased electricity use for air-conditioning, reduced driving force for natural ventilation, and the changes in life style and human behavior with reported studies on change of human temper and family violence, increased mortality due to heat stress, possible increase of influenza infection due to lower humidity, changing urban microbial population, increase in chemical reaction in the urban air, impact on building structure and materials etc. However, many of these impacts have not been well studied, though expected as seen from the rapidly growing literature on the impact of climate change. Conclusions: Man-made structures have a greater impact on the daily urban air temperature cycle through increased surface area, thermal storage, and reduced city ventilation. Our study poses questions about the future challenge of designing and controlling thermal environment and ventilation of our cities.

Abstract Number	**S-3-20-04**
Presenter	Mike Flynn*
Exposure	others
Health domains	other
Type of research	others

US Institute of Medicine Report: Climate Change, the Indoor Environment and Health and the US Environmental Protection Agency (EPA) Response

The US Institute of Medicine report commissioned by the US EPA concluded that climate change may worsen the quality of indoor air; it may worsen existing indoor environmental problems and introduce new ones as it alters the frequency or severity of adverse outdoor conditions. Report recommendations included: prioritize consideration of health effects into research, policy, programs, and regulatory agendas; make prevention of adverse exposures a primary goal in designing and implementing strategies to address health effects; and include collection of data to be used in making better-informed decisions in the future. EPA program areas that may need to be refined include technical guidance for building construction and maintenance, and public education regarding occupant behavior that could impact exposure to indoor pollutants. EPA's indoor air quality priorities for adaptation response include education and outreach on indoor air and climate change adaptation issues. Integration of climate change adaptation science and policy into current indoor air programs focused on homes, schools and large buildings is essential, as well as promotion of research on climate change adaptation. Research priorities include: develop health-based ventilation standards and inform design and operation criteria for mechanical ventilation systems; develop protocols or testing standards for evaluating emissions from indoor sources; evaluate effects on occupant health and productivity following alterations to the indoor environment in response to climatic changes, including weatherization and retrofitting of homes and/or buildings; identify future vulnerable populations that may be at greater risk from effects of climate change. Guidance on indoor air issues is available, free of charge, on the EPA website; www.epa.gov/iaq.

Abstract Number	**S-3-24-01**
Presenter	Raymond Neutra*
Exposure	no exposure
Health domains	ethics
Type of research	others

Pitfalls in the Diagnosis of "Manufacturing Doubt."

How would we craft a "gold standard" operational definition of the behavior called "manufacturing doubt" such that there would be a 100% diagnostic success when a person's behavior met that definition? How would we craft a less that perfect screening test with an acceptable sensitivity and specificity that we could apply when we suspected that an epidemiologist was engaged in "manufacturing doubt?" What is the differential diagnosis when we see symptoms that might be markers of "manufacturing doubt" that is, what other scientific behaviors resemble it? What is the prior probability of "manufacturing doubt" and the other behaviors that resemble it? What is the predictive value positive, of likely screening tests for this behavior? What is the cost of a falsely accusing or falsely exonerating a fellow epidemiologist of this behavior? These are the topics that will be covered in this proposed theoretical talk leading up to the symposium group discussions that will follow.

Abstract Number	**S-3-25-01**
Presenter	Timothy Buckley*, Liesel Seryak
Exposure	others
Health domains	other
Type of research	exposure measurement

6.1 Community Perception of Quality of Environment and Health Associated with Animal Agriculture

Background: There is growing appreciation that the health of the environment, animals, and humans are inextricably linked and should be viewed holistically. Concentrated animal feeding operations within rural communities provides a case in point. Aims: We sought to investigate community perception of environmental quality and benefit as a function of distance from animal feeding operations. Methods: For a community in Union County, Ohio, we first developed a survey instrument and then conducted a mailed census survey of all residences (n=1616) surrounding three nearby poultry CAFOs. The survey included questions about household demographics and activities, and level of concern over environment and health. The impact of the CAFOs were evaluated by comparing survey responses from homes in close proximity to the poultry operations (zone A), relative to more distal homes (zones B and C) with the most distal zone (D) serving as the reference in a logistic regression model. Results: Over a quarter (28.4%) of residents completed and returned the survey. Respondents tended to be older (median age of 55 y), homeowners (98%), longtime residents (average 19 y), with smaller percentages self-identifying as farmer (25%) and of those, raising livestock (39%). The most prevalent community concerns across all zones related to ecology (60% of respondents), odors (45%), and family health (40%). Logistic regression revealed significant ($p<0.05$) odds ratios (OR) comparing responses in the zone closest to poultry operations relative to the furthest reference zone for concern over: safety of recreational water contact (OR=3.5); safety of outdoor air (OR=7.3); odors and quality of life (OR=9.9); safety of soil contact (OR=12.2); impact on ecology (OR=4.1); and effect of environment on health of family (OR=3.1). Conclusions: These results suggest that living near poultry CAFOs has a detrimental impact on concern over environment and health. This is an important dimension to human wellbeing especially within rural communities.

Abstract Number	**S-3-25-02**
Presenter	Anastasia Sugeng*, Paloma Beamer, Eric Lutz, Celia Rosales
Exposure	pesticides
Health domains	other
Type of research	health impact assessment

6.2 Hazard-Ranking of Agricultural Pesticides for Chronic Health Effects in Yuma County, Arizona

Background: There are over 278,000 pesticides registered by the United States Environmental Protection Agency, making it unfeasible to sample for all pesticides applied in agricultural communities. Aims: Hazard-ranking pesticides based on use, toxicity, and exposure potential can help prioritize community-specific pesticide hazards. Methods: We applied hazard-ranking schemes for cancer, endocrine disruption, and reproductive/developmental toxicity in Yuma County, Arizona. We modified a cancer hazard-ranking scheme and developed novel schemes for endocrine disruption and reproductive/developmental toxicity. The hazard-ranking schemes accounted for pesticide use, toxicity, and exposure potential based on chemical properties of each pesticide. Pesticides were ranked as hazards with respect to each health effect, as well as overall chronic health effects. Results: The highest hazard-ranked pesticides for overall chronic health effects were maneb, metam sodium, trifluralin, pronamide, and bifenthrin. The relative pesticide rankings were unique for each health effect. The highest hazard-ranked pesticides differed from those most heavily applied, as well as from those previously detected in Yuma homes over a decade ago. The most hazardous pesticides for cancer in Yuma County, Arizona were also different from a previous hazard-ranking applied in California. Hazard-ranking schemes that take into account pesticide use, toxicity, and exposure potential can help prioritize pesticides of greatest health risk in agricultural communities. Conclusions: This study is the first to provide pesticide hazard-rankings for endocrine disruption and reproductive/developmental toxicity based on use, toxicity, and exposure potential. These hazard-ranking schemes can be applied to other agricultural communities for prioritizing community-specific pesticide hazards to target decreasing health risk.

Abstract Number	**S-3-25-03**
Presenter	Kristen Gibson*
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

6.3 Recent efforts in fecal source tracking and the connection to public health: Do we know more now than 10 years ago?

Background: Fecal source tracking (FST) is an area of research revolving around the need to investigate the sources of elevated levels of fecal indicator bacteria (FIB) such as generic Escherichia coli and enterococci—both utilized as indicators of microbial water quality. The primary goal of FST has often been to identify the source and if possible, eliminate the source. However, intrinsic to the goal of FST is to allow for estimation of human health risk due to exposure (ingestion, recreational) to contaminated water sources. Methods: Over the past decade, new methods in FST (e.g., transitioning from library-dependent to library-independent techniques) have been developing at a rapid rate with most only making it to the proof of concept stage of development while leaving knowledge gaps related to 1) feasibility and biological likelihood in the field setting; 2) how the novel method compares to other, published methods; and 3) if the method will actually aid in risk reduction with respect to human health. Results: Therefore the purpose of this overview is to understand the current shortcomings related to FST efforts in agricultural and rural settings and to discuss a rational approach to how FST methods can realistically be utilized to protect both water quality and public health. More specifically, shortcomings of FST include the increasing variety of FST methods utilized of which none have been demonstrated to work quantitatively over time; the continued lack of evidence correlating FST targets with pathogens; and the lack of any systemic evaluation to assess the value of FST results as they relate to risk characterization. Conclusions: For FST to be truly useful, we need to understand that no single method will be capable of adequately addressing the goal of protecting public health; thus, we should step back and approach FST with a toolbox mentality as well as with the mindset that FST may better conform to application at the local, watershed level as opposed to on a national or international scale.

Abstract Number	**S-3-25-04**
Presenter	Chris Heaney*
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

6.4 Environmental and occupational exposures to antimicrobial-resistant Staphylococcus aureus related to livestock agriculture

Background: Administration of antimicrobials to food animals, including non-therapeutically, can select for drug-resistant pathogens, such as methicillin-resistant Staphylococcus aureus (MRSA). In the United States, understanding of environmental and occupational MRSA exposure in settings related to livestock agriculture is improving, but evidence about occurrence of multidrug-resistant S. aureus (MDRSA) in these settings remains unclear. Additionally, little evidence exists comparing MDRSA nasal carriage among workers raising livestock with versus without antimicrobial selective pressure. Aims: To summarize evidence from recent studies of MDRSA occurrence in surface waters proximal to industrial hog operation fecal waste sprayfields and MDRSA nasal carriage prevalence among industrial compared with antibiotic-free livestock operation workers. Methods: Surface water samples from sites proximal to industrial hog operation fecal waste sprayfields and nasal swabs from workers at industrial and antibiotic-free livestock operations were collected. Antimicrobial susceptibility to 15 drugs and the molecular characteristics of S. aureus isolates was determined, including markers of livestock-association (tet-resistant, ST398, scn negative). MDRSA was defined as resistance to three or more classes of antimicrobials. Results: MRSA, MDRSA, and tet-resistant S. aureus isolates were detected in surface waters proximal to industrial hog operation fecal waste sprayfields. Industrial livestock operation workers carried MRSA and MDRSA that tended to be tet-resistant, ST398, and lacking the human-adapted scn gene, whereas MRSA and MDRSA isolates possessing all three of these livestock-associated characteristics were not observed among antibiotic-free livestock operation workers. Conclusions: The observed environmental and occupational occurrence of MRSA and MDRSA raises important questions about the safety of fecal waste management and antimicrobials uses in livestock production.

Abstract Number	**S-3-25-05**
Presenter	Soawapak Hinjoy*
Exposure	microbial environment
Health domains	infectious diseases
Type of research	exposure measurement

6.5 The epidemiology of hepatitis E virus and the relationship between infection in pigs and humans in a community of agricultural-food system in Nan, Thailand

Background: Several evidences suggest that pigs are reservoir of hepatitis E virus (HEV). No study in Thailand has been conducted to explore the transmission risks for HEV in pigs and humans. Aims: To define the burden of HEV in pigs and humans in Nan province, and evaluate the transmission of HEV among humans having direct or indirect contact with the pigs. Methods: The first study addressed the risks for HEV transmission between pigs in different sized farms, and possible risk factors among pigs in a cross-sectional study. We obtained sera and fecal samples from pigs to test for antibodies to HEV and HEV RNA. The second study addressed the association between occupational pig exposure to HEV infection among farmers and the general population in a cross-sectional study. All pig farmers from the first study were recruited in the second study. The comparison group resided in the same districts as the exposed group and the person must have had no history of occupational contact with any pigs. All participants were asked to give a blood specimen tested for HEV infection. Results: The first study found a 9.9% (87/879) seroprevalence of anti-HEV among pigs and 2.9% of pigs had HEV RNA positive fecal samples. All HEV sequences corresponded to genotype 3. Pigs raised on medium sized farms had higher anti-HEV seroprevalence than pigs raised on larger farms after controlling for other confounders. Better hygienic practices were used in larger farms compared with small or medium sized farms. The overall prevalence of anti-HEV was 23.0% (118/513) in the second study. There was no association between anti-HEV prevalence and direct exposure to pigs. Frequent consumption of organ meat ≥ 2 times per week was a significant risk factor for HEV seroprevalence, adjusted odds ratio (OR) 3.23, 95% confidence interval (CI) 1.15, 9.01. Conclusions: These studies establish that HEV is endemic among pig populations in Nan province. It appears that HEV infections in humans are acquired more frequently as a food-borne infection than by direct contact with pigs in this population.

Abstract Number	**S-3-26-01**
Presenter	Fred Vom Saal, Shelley Ehrlich*
Exposure	others
Health domains	other
Type of research	review

Differential information from blood vs urine levels in studies of endocrine disruptors

Background: The plastic monomer bisphenol A (BPA) is a good example of a short lived and rapidly metabolized chemical with endocrine disrupting activities. Numerous studies show associations between exposures and health outcomes based on linking urinary levels of BPA to the adverse health outcome. However, these studies provides no information regarding the proportion of chemical that is bioavailable in blood after exposure or the duration during which the chemical is bioavailable prior to being conjugated in the liver and excreted in urine by the kidneys. Aims: 1) To discuss the advantages and disadvantages of measuring exposures in epidemiology studies via urine measurements verses blood levels, and 2) to discuss whether estimates of human exposure to biologically active levels of BPA can be measured in blood, and 3) to discuss if measurement of total BPA in spot urine samples can be used to accurately determine actual exposure. Methods: I will review recent findings regarding the exquisite sensitivity of human and animal tissues and systems to BPA toxicity. I will also present the results of the NIEHS sponsored round robin to define methods and approaches to accurately measure BPA in human serum. Conclusions: There is a need in epidemiology studies for both measurement of urine levels of environmental chemicals and measurements in blood as these measurements provide important non-overlapping information. In the case of BPA, measurement of free BPA in blood is necessary to answer the question of whether there are levels of bioactive BPA in humans that could lead to health problem: data that cannot be ascertained from urine measurements. In addition urine measurements and back-calculations from spot urine levels may not provide accurate assessment of actual exposures.

Abstract Number	**S-3-26-02**
Presenter	Jenny Carwile*
Exposure	others
Health domains	other
Type of research	review

Comparing observational and experimental approaches in epidemiology: BPA example

Background: Exposure to environmental endocrine disruptors (EDCs) is thought to result in adverse health outcomes. Human studies of EDCs have typically been observational rather than experimental in nature. However, exposure too many endocrine disruptors can be attributed to the use of common household goods such as food packaging and personal care products, and the randomization of such items in an already exposed population is likely to be ethical. This opens the door for applying an experimental approach to various areas of related research, including the identification and quantification of sources of exposure. Indeed, experimental studies, in which the biomarker concentration of a given individual is compared under conditions of exposure and non-exposure, may provide an ideal approach for investigating the impact of a particular exposure source. Aims: To use the example of dietary sources of bisphenol A (BPA) exposure to examine how experimental designs may be instrumental in exposure assessment research in humans. Methods: I will discuss several epidemiologic studies that quantified dietary sources of BPA using an experimental approach and contrast them with similar observational studies. Results: The primary advantage of the experimental design is the ability of the researcher to assess within-person change in BPA attributed to a particular dietary exposure despite considerable between-person variability. On the other hand, results from observational studies can be generalized to larger and more diverse populations. Conclusions: Epidemiologists commonly use animal studies to inform the biological mechanism of a prospective study, however they would likely benefit from considering the experimental design of such studies as well.

Abstract Number	**S-3-26-03**
Presenter	Nicolas Olea*
Exposure	others
Health domains	other
Type of research	review

Non-monotonic dose responses in epidemiology studies: lessons learned from cell culture and animal studies

Background: Although many epidemiological studies originally focused on occupationally or accidentally exposed individuals, more recent studies have suggested wide-ranging effects of low doses of chemicals with endocrine activity (endocrine disruptors, EDCs) on the general population. Effects occurring in the range of typical human exposures or occurring at doses lower than those typically used in standard testing protocols are called low-dose effects. A concept related, but not synonymous, to low dose is non-monotocity. A dose response curve is non-monotonic (NMDR) when the slope of the curve changes sign somewhere within the range of doses examined. The consequence of NMDRs is that a safe dose determined from high doses does not guarantee safety at lower doses. If NMDR occurred in epidemiology studies outcomes might be missed by assuming a linear response. Aims: To review the data and mechanistic explanations for NMDR from the animal literature and to focus attention on the possibility of NMDRs in epidemiology studies. Results: Hormones and EDCs from a large number of categories with variable effects on the endocrine system produce NMDRs in animal studies. NMDR have recently been observed in epidemiology studies under conditions where there is a wide range of exposures, and where the data analysis specifically looked for NMDR. Conclusions: Many epidemiology studies compare the lowest exposure to higher quartiles or sextiles of exposure. However it may not be scientifically correct to assume a linear relationship with the largest effect occurring at the highest exposure as the dose response may be non-monotonic with the largest effect occurring at the lowest or intermediate exposure level depending on the range of exposures covered. It is important that epidemiology studies look for NMDR when studying EDCs.

Abstract Number	**S-3-26-04**
Presenter	Shanna Swan*
Exposure	others
Health domains	reproductive outcomes
Type of research	review

Shared models and mechanisms? The examples of DES and phthalate syndrome

Background: Historically, major environmental toxicants could be linked to human health outcomes because these early exposures were large and visible and risks to individuals were dramatic. The challenge we are now facing is that of detecting human health risks from invisible, low-level exposures that impact health predominantly at the population level. Endocrine disruption is, I suggest, the primary means by which such exposures impact health. To identify the impacts of these chronic low-levels exposures on human populations, animal toxicology studies can be invaluable as they can provide data that can then be assessed in epidemiology studies. Epidemiology studies can also inform animal toxicology as to possible links between exposures and effects. Aims: 1) To use the example of the drug diethylstilbestrol (DES) to examine how human studies can inform animal toxicology; and 2) to use the example of the phthalate syndrome to discuss how animal toxicology can inform epidemiology. Methods: I will review the historical interplay of animal and human studies in these two examples. Many outcomes of prenatal DES exposure in humans are seen in rodent studies, but not all. Similarly, not all aspects of the phthalate syndrome described first in rodents have been observed in humans. Examining the similarities and differences between outcomes of these exposures in humans and animals demonstrates the value (and challenges) of these cross-species comparisons. Conclusions: When animal and human data are available on an exposure-outcome relationship, and scientists in both areas are willing to learn from each other both the epidemiology and the toxicology benefit. Ultimately the conclusions of both are strengthened, with the result that public health is better protected.

Abstract Number	**S-3-27-01**
Presenter	Anke Huss*, Hans Kromhout, Roel Vermeulen
Exposure	electromagnetic fields
Health domains	neurobehavioral effects
Type of research	review

Current knowledge on RF exposure assessment and Children's health

The World Health Organization has put prospective cohort studies in children and adolescents on health effects of radiofrequency electromagnetic fields (RF-EMF) on the list of topics with high priority research needs. Exposures to these fields from modern telecommunication technology have developed into a nearly ubiquitous feature of our everyday environment. If there are any health effects from these exposures, the public health relevance would be expected to be high, since nearly everyone is exposed. It has been suggested that children may be more vulnerable due to their developing nervous systems and because of prolonged exposures from early childhood onwards. So far, only few studies have systematically evaluated exposures to RF-EMF in children, and even fewer have addressed potential health effects in this group. A particular challenge is that exposures in small children cannot be assessed with the same methods as for adolescents or adults, e.g. with exposimeters. One of the main challenges is the assessment of exposures to these fields, due to the high spatial variability of the fields and the multitude of sources that add to the exposure. Exposure is also expected to shift considerably during childhood, from a larger share of environmental RF-EMF while children are still very small, to an increasing exposure from communication devices as children get older. Behaviour and cognitive outcomes have been defined to be of special interest in the evaluation of health effects from the exposure to RF-EMF. The own use of mobile phones, however, can also be related to cognitive training and social interaction, independent of the exposure to RF-EMF. It is therefore particularly important that studies can differentiate between effects of the exposure to RF-EMF and those related to the usage of mobile phones as such. Of concern are also differences in SES that might be related to both exposure and outcomes. This presentation will give an overview over the issues at hand.

Abstract Number	**S-3-27-02**
Presenter	Monica Guxens*, Manon van Eijsden, Beekhuizen Johan, Eva Loomans, Tanja G.M. Vrijkotte, Rob T. van Strien, Hans Kromhout, Roel Vermeulen, Anke Huss
Exposure	electromagnetic fields
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Environmental radiofrequency electromagnetic field exposure and cognitive function and behaviour problems in 5-6 year old children

Background: Little is known about the exposure of children to radiofrequency electromagnetic fields (RF-EMF) and potentially associated health effects. Until the age of 5, mobile phone use is likely negligible and environmental RF-EMF exposures are expected to contribute largely to the total RF-EMF exposure. Aims: We assessed the relationship between residential RF-EMF exposure from mobile phone base stations and children's cognitive function and behaviour problems at 5-6 years of age. Methods: Cross-sectional study on children aged 5-6 years based on data from the ABCD study, a community-based birth cohort study in Amsterdam, The Netherlands. Environmental RF-EMF exposure to mobile phone base stations signals at children's home was estimated with the 3D geospatial radio wave propagation model NISMap. Children's cognitive function was assessed using 2 reaction time tasks and 2 visuomotor coordination tasks from the Amsterdam Neuropsychological Tasks program, a computerized assessment program. Teachers and mothers reported child behaviour problems using the Strength and Difficulties Questionnaire. Results: A total of 2,067 children were included in the analysis. Environmental RF-EMF exposure was not associated with any of the cognitive tasks. No relationship was found between environmental RF-EMF exposure and teacher-reported child overall behaviour problems. Children in the third exposure quartile showed a statistically significant marginal increased risk of having overall behaviour problems as reported by mothers. No relationship was observed between environmental RF-EMF exposure and the rest of child behaviour problems assessed. Conclusions: Environmental RF-EMF exposure at home was not related with most of the cognitive tasks or behaviour problems in children aged 5-6 years. However, an isolate finding was observed among many tested outcomes that may be chance finding. In addition, we cannot exclude residual confounding by socioeconomic position-related aspects.

Abstract Number	**S-3-27-03**
Presenter	Mobi-Expo study group*
Exposure	electromagnetic fields
Health domains	cancer
Type of research	exposure measurement

Mobi-Expo: Using software modified smartphones to characterize mobile phone use in children, adolescents, and young adults

Background The rapid increase in mobile phone use in young people has generated concern about possible health effects of exposure to radiofrequency (RF) fields. The objective of Mobi-Expo is to conduct a multinational study to characterise the use of mobile phones in young people and to improve RF exposure assessment within the framework of MOBI-Kids, the case-control study of brain tumours risk in young people. Specific objectives include: characterize mobile phone use habits; characterize the laterality of mobile phone use; estimate the proportion of use of different types of networks; and validate self-reported mobile phone use in MOBI-Kids. Methods Mobi-Expo is collecting data in MOBI-Kids countries from volunteers using (1) provided software modified smartphones (SMSPs) and (2) their own Android smartphones. On the SMSPs and the volunteer-owned phones a software application (API – XMobiSense) is installed to record data on phone use and characteristics. The study is conducted with volunteers from three age groups: 10-14, 15-19, and 20-24 years (covering the MOBI-Kids age range). The subjects are selected to represent both sexes, a range of socio-economic strata, and geographical areas covered by MOBI-kids. In each country Mobi-Expo is conducted on at least 90 subjects (30 per age group). These 90 subjects are divided into 45 non-Android users (who receive an SMSP) and 45 Android users (who install the API on their phone). Phone use characteristics will be evaluated, and phone use recorded by the API will be compared to information obtained from MOBI-Kids-based questionnaires answered six months later. Results Volunteer recruitment began in October 2012 in three countries (Australia, Spain, and the Netherlands). The presentation will focus on the first results from these countries. Data collection will continue in remaining countries through 2013. Conclusions Data on use of mobile phones in young people is needed to characterize exposure and improve exposure assessment in epidemiological studies.

Abstract Number	**S-3-27-04**
Presenter	Katharina Roser*, Anna Schoeni, Martin Röösli
Exposure	electromagnetic fields
Health domains	other
Type of research	exposure measurement

Propagation modelling, mobile phone traffic data, questionnaires, personal measurements and mobile phone apps: an integrated approach for exposure assessment

Background The ongoing HERMES (Health Effects Related to Mobile PhonE use in adolescentS) study aims to prospectively investigate whether the exposure to radiofrequency electromagnetic fields (RF-EMF) emitted by mobile phones and other wireless communication devices affects cognitive functions or causes behavioural problems and non-specific health disturbances in adolescents. The exposure assessment will be approached using propagation modelling, questionnaire data, objective mobile phone traffic data, personal RF-EMF measurements and apps (mobile phone applications). Aims The objective is to predict the mean RF-EMF exposure for the study population of the HERMES study. Methods Detailed mobile phone traffic data are provided from the mobile phone operators. Residential exposure from fixed sitetransmitters will be assessed using a validated geospatial propagation model and RF-EMF measurements in the school buildings were carried out. Asubgroup of the study participants will participate in personal measurements carrying a portable measurement device, filling in a time-activity diary and using apps. The time-activity diary app records the locations and activities and tracks the position of the participants. Another app traces the field strength and the emission source of different frequency bands and yet another app records how the mobile phone is being used in terms of laterality, amount of data traffic, calling and texting. Results 24 schools and 441 adolescents participated in the baseline investigation of the HERMES study. Preliminary results of measurements in 22 schools show an average RF-EMF exposure of 0.134 V/m and a median of 0.121 V/m. Highest observed exposure value in a school building was found to be 0.225 V/m. Conclusions The integrated approach used for the exposure assessment will allow detecting which role the mobile phone and other wireless communication devices play for the personal RF-EMF exposure in the everyday life of the adolescents.

Abstract Number	**S-3-27-05**
Presenter	Michael Abramson*, Christina Dimitriadis, Skye Macleod, Catherine Smith, Geza Benke, David Darby, Jordy Kaufman, Malcolm Sim, Rory Wolfe, Rodney Croft
Exposure	electromagnetic fields
Health domains	neurobehavioral effects
Type of research	cross-sectional study

Use of mobile phones and cognitive effects in primary school children

Background: The effects of radiofrequency exposure from mobile phones on cognitive development in children are not known. Aims: To assess current use of mobile telephones in a representative sample of primary school children; and to determine whether there is any association between use of mobile telephones and cognitive function. Methods: We recruited 619 students from 37 schools in Melbourne and Wollongong. Parents completed a questionnaire, which included validated questions from the Interphone study. Children completed a neurocognitive test battery (CogState Research™) and the Stroop colour word test. These measures were analysed by multiple linear regression to adjust for effects of age, sex, languages other than English, handedness and using robust standard errors to allow for clustering by school. Results: We recruited 290 (46.9%) boys and 329 (53.1%) girls with a mean [SD] age of 9.9 [0.48] years. Only 187 (30.2%) currently owned or used a mobile phone. The median[IQR] total number of voice calls made and received was 2.5[1, 5] per week. The median number of SMS sent and received was 0.5[0, 3.5] per week. The response time to the Go-No go task was increased in the highest quartile of calls (p= 0.01), compared to those without a phone. The accuracy of the one card learning task was greater among those who used SMS <3.5/week (p=0.007). The response time to the identification task was increased (p=0.045) and the accuracy of the one back memory task reduced (p=0.014) in the highest frequency of calls and lowest use of SMS. There were no significant associations between either voice calls or SMS with performance on other tasks or the Stroop test. Conclusions: Less than a third of children in this study used mobile phones. We have not demonstrated any consistent dose response relationships between either voice calls or SMS with signal detection, identification, working memory, response inhibition, learning or visual motor function. Supported by NHMRC

Abstract Number	**S-3-30-01**
Presenter	Samantha Malone*, David "Brook" Lenker
Exposure	others
Health domains	policy
Type of research	others

Encouraging Unconventional Natural Gas Development Data Transparency with FracTracker.org

Unconventional natural gas development (UNGD) in shale formations, often referred to as 'fracking,' is a controversial subject for which the public needs accessible and reliable data in order to make well-informed decisions. Data that are collected are not always published online, hindering regulatory transparency and public access to critical information. Such was the case when the safety of UNGD became a point of contention in the United States. Until at least 2010, the locations of wells drilled, wells permitted, and violations in the U.S. were only accessible by conducting a file review through each state's regulatory agency. By the time that regulatory bodies began to make online data available for public consumption, considerable uncertainty and concern had developed. This situation led to the launch of FracTracker.org. The FracTracker Alliance is a non-profit organization dedicated to enhancing the public's understanding of the impacts of the global shale gas and oil industry by collecting, interpreting, and sharing data through FracTracker.org. This presentation will demonstrate the capabilities of the site's geographic information system and discuss how FracTracker.org is currently being utilized. The information being transmitted provides awareness and information to protect public health, the environment, and socioeconomic well-being from the potential impacts of UNGD. Developing collaborations outside of the U.S. is of significant interest to the FracTracker Alliance. A similar system could be used to satisfy the emergent international demand for UNGD data and maps.

Abstract Number	**S-3-30-02**
Presenter	Elaine Hill*
Exposure	others
Health domains	reproductive outcomes
Type of research	case-control study

Hydraulic Fracturing and Infant Health: Evidence From Pennsylvania and Colorado

Background: The benefits and costs of hydraulic fracturing are currently being hotly debated in the case of shale gas development (commonly known as "fracking"). Over the last decade, 31 states have begun using this technology. There are numerous environmental and health concerns related to this technology that may outweigh the employment and income benefits. Aims: This research studies the potential impacts on neonatal health from exposure to drilling during pregnancy. I explore the effects of the initial introduction of hydraulic fracturing in Pennsylvania (began 2008) compared to drilling in Colorado (began 1985). Methods: Residential location on the birth certificate records is linked to the well head locations using GIS. All analyses focus on singleton births and adjust for a rich set of maternal characteristics including age, race/ethnicity, education, parity, previous risky pregnancies, and smoking and drinking behavior. The infant health measures of interest are term birth weight, gestation, low birth weight and premature birth. In Pennsylvania, maternal exposures within 2.5 km of a shale gas well are compared before and after drilling for birth cohorts from 2003-2010. In Colorado, maternal exposures within 1 km are compared to those 2-5 km from a well for birth cohorts from 1990-2011. Results: With a sample of 2,500 infants born after drilling within 2.5 km of a well in Pennsylvania (PA), I find increased prevalence of low birth weight (LBW), reduced term birth weights on average and reduced 5 minute APGAR scores. In Colorado (CO), with a sample of 22,000 births within 5 km of a well, infants born within 1 km of a well weigh less, have shorter gestation periods and are more likely to be LBW and premature than those who are born to residences 2-5 km from a well on average. Conclusions: Maternal exposure to drilling in both states induced a statistically significant increased risk for reduced term birth weight and low birth weight on average. In CO, but not PA, an increased risk of premature birth is also detected at standard levels of significance.

Abstract Number	**S-3-30-03**
Presenter	Gerry Ertel*, Christa Seaman
Exposure	ambient air pollution
Health domains	other
Type of research	review

Implementing Sound Regulations to Minimize Air Emissions Associated with Natural Gas Extraction

The three primary airborne sources from shale gas operations are: fugitives; venting; and flaring. Venting and flaring are the easiest to address with regulations and best practices. Flaring is usually associated with oil production; however it does occur during gas production such as in emergency conditions or during well testing. Fugitives are more challenging as they are unintentional and often require emission surveys to detect. However as these emission sources are not unique to shale gas operations and regulations already exist to manage them in most jurisdictions. A review of existing Canadian and European rules around casing vent flow and other fugitive emissions illustrates the emphasis already placed on these issues. For example in Alberta flaring has been reduced by 71.5% since 1996 and venting by 56.4% since 2000. In the EU flaring and venting regulations also exist and are similar to those in Alberta. The primary concern around methane fugitive emissions is casing vent flow caused by well cement failure. As cement failure has many other ramifications this situation is also already addressed by regulation. Diesel exhaust is also prevalent in the field due to the many heavy trucks needed to haul equipment, chemicals and water as well as the fracturing pumps and drilling rigs. Regulations are also in place to manage the emissions from diesel combustion in heavy vehicles as well as drilling rigs. Technology also plays a role in reducing the impact of shale gas development on air quality. Advancements in cement formulations, well design and equipment selection will further enhance the reductions achieved through regulation. In conclusion the natural gas sector is heavily regulated globally with respect to methane, hydrocarbon and particulate emissions and significant reductions have already been achieved.

Abstract Number	**S-3-30-04**
Presenter	Christa Seaman*, Deanna Grant, Shawn Baxter
Exposure	water
Health domains	other
Type of research	others

Lowering Impacts of Natural Gas Drilling in Dawson Creek, BC, Canada

Growing global energy demands has increased the use of hydraulic fracturing for the economic extraction of the world's shale gas. The increase has raised concerns from stakeholders about the impact on the environment, drinking water and human health. As a major producer of shale gas, Royal Dutch Shell has developed a set of five operating principles to address the concerns of safety, footprint, air, water and community. The collaboration between Shell Canada and the City of Dawson Creek on a reclaimed water facility in northeastern BC exemplifies these principles. Benefits to the Dawson Creek as a result of the facility include a reduction in: water taken from the Kiskatinaw River; treated sewage (926/100ml faecal coliform) discharged to Dawson Creek; and water transferred between the Kiskatinaw and Pouce Coupe watersheds. An 85% reduction in discharge to Dawson Creek will improve dilution rates during periods of low flow when a majority of the flow is due to the City discharge. Using reclaimed water for industrial purposes alleviates the strain on the growing community's drinking water supply and the sale of reclaimed water also provides a new revenue stream for the municipality. Benefits to Shell include: virtual elimination of Shell's draw on fresh water in the area by providing guaranteed access to reclaimed water. A pipeline will link the reclaimed water facility to Shell's central water hub where it will be mixed with flowback water for future fracturing operations. The pipeline is expected to eliminate 3,000,000 km a year of heavy road traffic, over the course of full field development, resulting in: reduced diesel exhaust, road dust, and noise as well as increase road safety. The Dawson Creek reclaimed water facility demonstrates how sound operating principles and innovative collaborative agreements can result in significant advances in sustainable development. This project alone has made strides in river health, air quality and road safety.

Abstract Number	**S-3-30-05**
Presenter	David F Goldsmith*
Exposure	others
Health domains	respiratory disease
Type of research	review

Silica Dust is a Serious Fracking Hazard

Background: Fracking involves silica dust hazards for both frack sand mining and fracking fluid mixing. Research has demonstrated that respirable silica is a very serious hazard from onsite fracking fluid mixing, with levels that exceed the protective factors from dual cartridge facemask respirators. Aims: We will present the air sampling data that confirms the respiratory hazards, and recommendations from U.S. OSHA and NIOSH for prevention and control. We will review the silica dust issue where frack sand is mined, predominately in Wisconsin and Minnesota. Control methods: Dust capture and automating the fracking fluid mixing offer two means to control dust on the fracking site. Dust control for frack sand mining and milling requires the use of wet methods. Both sets of operations require increased worker and management education. Conclusions: Failure to control silica dusts for frack sand mining and fracking fluid mixing will lead to increased employee risk for silica-related illnesses including silicosis, lung cancer, autoimmune diseases and kidney ailments. It may also prevent the opening of new natural gas exploration sites. Future research and policy will be discussed.

Abstract Number	**S-4-06-01**
Presenter	Kristie Ebi*
Exposure	climate change (temperature)
Health domains	other
Type of research	others

Health in the New Scenarios for Climate Change Research

Background: The scientific community is developing new integrated scenarios to facilitate interdisciplinary research and assessment to explore the range of possible future climates and related physical changes that could affect human and natural systems; how these could interact with social, economic, and environmental development pathways; the degree to which mitigation and adaptation policies can avoid and reduce those risks; the costs and benefits of various policy mixes; and residual impacts under alternative pathways. Methods: The new scenario process consists of three phases: developing four emission pathways (Representative Concentration Pathways) of how emissions could develop over the 21st century; new descriptions of future socioeconomic conditions (Shared Socioeconomic reference Pathways or SSPs); and creating scenarios that integrate the descriptions of socioeconomic development with the climate change projections and with assumptions about climate policies. Results: The SSPs define the state of human and natural societies at a macro scale and include a narrative storyline and quantified measures that define the high-level state of society as it evolves over the coming century. The SSPs can be used as boundary conditions within which the health sector can develop detailed narratives, containing qualitative and quantitative elements, of the evolution of public health under different pathways over coming decades. For example, under a sustainability pathway, overall health improves significantly, with reductions in the burden of climate-sensitive health outcomes and increased capacity to adapt to the health risks of climate change. Under a moderate pathway that is in many ways a continuation of current trends, there would be slow gains in reducing the burden of climate-sensitive health outcomes in low-income countries. A rocky pathway is a world of increasing mortality from climate-sensitive health outcomes and possibly falling life expectancy in low-income countries because of increases in childhood mortality.

Abstract Number	**S-4-06-02**
Presenter	Vladimir Kendrovski, Margarita Spasenovska*, Bettina Menne
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

The public health impacts of climate change in Macedonia

The public health impacts of climate change in Macedonia Vladimir Kendrovski1, Margarita Spasenovska2, Maria Kisman2, Allison Thorpe3, Bettina Menne4 1Medical faculty, Skopje, FYR Macedonia 2WHO-CO, Skopje, FYR Macedonia 3Brunel University, London 4WHO, ECEH, Bonn, Germany Background. Scenarios for Macedonia anticipate an average increase of 3.8 °C by 2100, more frequent and more intense heatwaves, droughts and flood events.Climate change adaption has been established as a priority within existing international and national policy instruments. Aims. The aims were to assess the health effects of climate change and to develop a national adaptation strategy and action plan. Methods.A variety of qualitative and quantitative methodologies were used: Literature reviews, interviews, focus group, time series and regression analysis, damage and adaptation cost estimation, scenario based assessment, and stakeholder engagement. The development of a national adaptation strategy followed a public health strategy process developed by the WHO Europe. Results. Climate change poses a significant threat to population health in the Former Yugoslav Republic of Macedonia. An increase in average monthly temperatures of only 1ºC compared to the period 1996–2000 significantly influences the monthly distribution of total mortality. Climate change-attributed costs of approximately € 2.6 million were calculated. Projected direct health impacts include 5-10% higher salmonellosis notifications for each degree increase in weekly temperature, an increase in pollen distribution in early spring (March), and a change in the presence of vectors. Conclusions. The generation of a robust evidence base, a coordinated and systematic approach to climate change research and the development of robust stakeholder engagement can be used to support the formulation and implementation of sustainable, multisectoral strategies and promote adaptive capacity.

Abstract Number	**S-4-06-03**
Presenter	Jan Semenza*
Exposure	climate change (temperature)
Health domains	infectious diseases
Type of research	others

Using integrated human, animal, environment and climate infectious disease surveillance to anticipate risks and response

Background Global climate change is here to stay. Attributing current or present infectious disease risks to climate change is difficult, in part due to the lack of long-term surveillance data. Moreover, climate change risk of infectious diseases is a function of current conditions, future vulnerabilities, adaptive capacity, and societal sectors (e.g. water management, agriculture, animal husbandry, land use, health sector). Aim To assess whether current surveillance systems for infectious diseases at the EU level need to be adjusted to monitor climate change impacts. Methods The current surveillance systems in the EU for infectious diseases and their environmental drivers were reviewed including direct temperature effects, indirect effects caused by changes in seasonal climate, the length of seasons, and in precipitation patterns. These impacts were assessed through weighted risk analysis that took into account the strength of the climate change link in relation to the impact of the disease on society. Results The interplay of the different EU surveillance systems was analysed in light of climate change drivers. Seven diseases were identified of being suboptimal in terms of current surveillance: Lyme borreliosis; tick-borne encephalitis; visceral leishmaniasis; dengue fever; chikungunya fever; Rift Valley fever; Vibrio spp. Improvements to the surveillance system are discussed along with early warning systems to forecast potential impacts of infectious disease from climate change. Conclusions This analysis calls for specific improvements to the current surveillance system in the EU for these seven pathogens. Moreover, an early warning system for specific infectious diseases might be able to anticipate some of these threats, by using climatic and environmental precursors of disease.

Abstract Number	**S-4-06-04**
Presenter	Paola Michelozzi*, Francesca de Donato, Bertil Forsberg, Klea Katsouyanni, Isabella Annesi-Maesano, Virginia Murray, Bettina Menne, PHASE collaborative Group
Exposure	climate change (temperature)
Health domains	other
Type of research	time series study

Identifying susceptible populations for public health action. Results from the PHASE project.

Background and aims: Extreme weather events (EWEs) have been increasing as a result of climate change. An objective of the European funded PHASE project, is to define subgroups of the population susceptible to EWEs such as heat waves, cold spells, floods, forest fires and air pollutants. Methods: Case-study analyses among PHASE cities were carried out to estimate the effects of EWEs and identify susceptible subgroups using different methodologies (time series, case cross over analysis and cohort approach). Where primary studies were not yet performed, a literature review was carried out to summarize susceptibility factors to EWEs. Results: Analyses from PHASE show: Heat. In the last decades, the effect of heat in the 65-74 age group is increasing while among the very old (75+ years) the effect is declining and there has also been a reduction in the harvesting effect. An effect of high temperatures among children was also observed, especially for respiratory diseases. Exposure to high temperatures increases the risk of preterm births (+2% for every 1°C increase). Among cohorts of adult patients within chronic diseases (Diabetes, COPD, MI survivors, CHF, Psychiatric disease) an increase in deaths during extreme heat days was observed. Floods. The indirect health effects of floods include respiratory disease, mental health, gastroenteritis; children and persons with chronic-related conditions are most at risk. Specific case studies within PHASE are ongoing. Air pollution\Forest Fires. Through the use of satellite data, a EU map of the areas at-risk to fires was defined and an emissions inventory will allow to estimate the health effects of wild fires in selected case studies. The health effects of urban air pollution seem to be exacerbated during extreme temperatures, especially for respiratory and cardiovascular causes. Conclusions: Specific public health measures should be focused on subgroups that will suffer the greatest health burden through life as a consequence of exposure to EWEs. Results from the PHASE project on subgroups susceptible to EWEs need to be integrated in public health guidelines.

Abstract Number	**S-4-06-05**
Presenter	Bettina Menne*
Exposure	climate change (temperature)
Health domains	other
Type of research	health impact assessment

2893: Global Climate Change and Health- Building bridges between science and practice

From science to policy making: A seven county study in southeast Europe, the Russian Federation and Central Asia Background. Between 2009 and 2011 in seven European countries (Albania, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan, the Former Yugoslav Republic of Macedonia), climate change vulnerability assessments have been carried out and national health adaptation strategies developed. The findings of this large study will be presented. Aims. The aims were to assess the health effects of climate change and to develop a national adaptation strategy and action plan in each of the seven countries. Methods.A variety of qualitative and quantitative methodologies were used: Literature reviews, interviews, focus group, time series and regression analysis, damage and adaptation cost estimation, scenario based assessment, and stakeholder engagement. The development of a national adaptation strategy followed a public health strategy process developed by the WHO Europe. Results. The scale and the variety of found health effects of climate change are considerable: higher morbidity in reindeer herders from permafrost melting; child malnutrition in Central Asia; heat-wave mortality in Southeast Europe - to name a few. This diversity requires targeted public health approaches. This was enabled through active stakeholder involvement into health priority setting and development of national health adaptation strategies. Conclusions. The generation of a robust evidence base, a coordinated and systematic approach to climate change research and the development of robust stakeholder engagement can be used to support the formulation and implementation of sustainable, multisectoral strategies and promote adaptive capacity.

Abstract Number	**S-4-10-01**
Presenter	Karen E. Peterson*, Karen E. Peterson, Adrienne Ettinger, Tiffany Yang, John D. Meeker, Brisa N. Sánchez, Joyce Lee, Dana Dolinoy, Howard Hu, Martha Maria Tellez-Rojo Solis
Exposure	biomarker
Health domains	obesity
Type of research	cohort study

Association of in utero and peripubertal EDC exposures with measures of metabolic syndrome risk

Background: Animal studies suggest in utero exposures to endocrine disrupting chemicals (EDCs) have differential effects by sex on adolescent fat mass and risk of metabolic syndrome, but few human studies account for effects of EDC exposures during the pubertal transition. Aim: Examine the impact of in utero and peripubertal exposures to lead, BPA and phthalates on measures of metabolic syndrome risk at ages 8-13 in a well-characterized Mexico City birth cohort. Methods: Among 118 males and 130 females, mean age 10.3 (SD 1.7) years, we modeled the association of log-transformed maternal bone lead at 1 month postpartum, peripubertal blood lead and phthalates and bisphenol A (BPA) from maternal 3rd trimester and peripubertal urines adjusted for specific gravity on: fasting leptin, glucose, high density lipoproteins (HDL), and triglycerides (TG), adjusting for sex, age, maternal education, socioeconomic status, and birth cohort. Results: In utero lead exposure (mg/g tibia bone) was associated with higher HDL (0.75 mg/dL, p=.0005) in males, but concurrent blood lead with lower HDL (-3.7, p=.06) in females. Adolescent BPA (ng/ml) was marginally associated with higher log levels of leptin (0.21, p=.07) in males and with glucose (8.83 mg/dL, p=.10) in a subsample of both sexes (n=32). Phthalates were negatively related to adolescent log leptin levels in males (3rd trimester MIBP: -0.24, p=.05) and females (3rd trimester MBzP: -0.17, p=.03; concurrent MBP: -0.19, p=.03). In the subsample (n=32), most 3rd trimester phthalates were significantly associated with 5-8 mg/dL lower adolescent HDL levels; concurrent MEP was associated with higher glucose (4.0 mg/dL, p=.05) and MEHHP and MEOHP with higher TG (p<.08). Conclusions: Representative EDC exposures to lead, BPA and phthalates in utero and peripuberty were differentially related by sex to measures of metabolic syndrome risk, particularly HDL, and the magnitude of effect estimates varied by EDC and timing of exposure.

Abstract Number	**S-4-10-02**
Presenter	Lawrence H Kushi*, Frank M. Biro, Mary Wolf
Exposure	others
Health domains	obesity
Type of research	cohort study

Childhood Obesity and the Environment: Insights from the Puberty Studies of the NIEHS/NCI Breast Cancer and the Environment Research Program

Background: The increasing prevalence of obesity in childhood suggests substantial adverse health effects, from greater risk of metabolic diseases at younger ages, to long-term risk of diseases of adulthood such as breast cancer. Setting: The Puberty Studies of the Breast Cancer and the Environment Research Program (BCERP) enrolled 1,239 girls aged 6-8 y at baseline examination in a longitudinal study of onset of puberty and other hallmarks of sexual maturation. Study participants include girls from East Harlem in New York City, the Greater Cincinnati, Ohio, area, and the San Francisco Bay Area. Methods: Data collection is ongoing; study participants have generally been seen for clinical assessments and data collection on an annual basis. As body fatness is a major determinant of puberty, visits included assessment of height, weight, waist and hip circumferences, and other measures of adiposity. Other data include food intake, physical activity, environmental exposures, the built environment, and behavioral factors. Biospecimens include urine and blood (on a subset) samples, and these have been analyzed for select hormonally-active chemicals. Results: At baseline, approximately 30 percent of the study population had body mass index (BMI) greater than the 85th percentile that defines overweight by the Centers for Disease Control and Prevention standards. High rates of overweight and obesity continue to be observed at each follow-up exam. The focus of most current analyses has been on age at onset of puberty, a main outcome of these studies. However, these studies provide an opportunity to examine the impact of various lifestyle and environmental exposures on childhood obesity. Results from these and other analyses will be described and presented. Conclusions: The Puberty Studies of the BCERP provide an outstanding opportunity to examine environmental factors associated with longitudinal development of obesity during childhood and adolescence in girls. Acknowledgement: Presented on behalf of the "Puberty Study Research Team"

Abstract Number	**S-4-10-03**
Presenter	Brenda Eskenazi*, Kim Harley, Marcy Warner, Asa Bradman, Nina Holland
Exposure	persistent organic pollutants
Health domains	obesity
Type of research	cohort study

Environmental endocrine disruptors, growth and pubertal development in Mexican-American girls

Background. Overweight and obesity is on the rise in the US and in other industrialized countries. One of the highest risk US populations is Mexican-Americans. This population may also be at high risk for exposure to certain endocrine disruptors because of recent immigration from Mexico (DDT) and residence in California (PBDEs). Aims. We examine the relationship of DDT, Bisphenol A and PBDE flame retardants and childhood obesity in the CHAMACOS cohort. Methods. We enrolled 601 pregnant women primarily of Mexican origin and have followed their children (currently 12 years old). We measured height, weight, and waist circumference at each visit. Starting at child age 9, we also assessed Tanner staging to know onset of puberty. We measured PBDEs and DDT in maternal (prenatal) and child blood and BPA in maternal (prenatal) and child urine. Results: At 7 years, 36% of the children were obese. We found that prenatal maternal o,p'-DDT, p,p'-DDT, or p,p'-DDE levels were non-significantly associated with increased odds of obesity; however, with increasing age at follow-up, we observed a significant trend towards a positive association. In contrast, prenatal urinary BPA concentrations were associated with decreased BMI at age 9 in girls but not boys. These findings were strongest in pre-pubertal girls and the trend seemed to be changing with puberty. However, BPA concentrations at age 9 were positively related to BMI, waist circumference, fat mass, and overweight/obesity at age 9 in boys and girls. We will also present results for associations with maternal and child PBDE levels. Conclusions: Endocrine disrupting chemicals may be associated with both decrease and increase in body mass in children and this relationship may depend on time of exposure and pubertal onset. Acknowledgement: This work was supported by PO1 ES009605 and R01 ES017054 from the NIEHS and R82670901, RD83171001, and RD83451301 from the U.S. EPA.

Abstract Number	**S-4-10-04**
Presenter	Andrew Rundle*, Michelle Maresca, Lori Hoepner, Antonia M. Calafat, Frederica Perera, Robin Whyatt
Exposure	ambient air pollution
Health domains	obesity
Type of research	cohort study

Prenatal exposures to polycyclic aromatic hydrocarbons and di-(2-ethylhexyl)-phthalate and body size in childhood.

Background: there are concerns that prenatal exposures to endocrine disrupting chemicals in the environment increase children's risk of obesity. Aims: to determine whether prenatal exposures to polycyclic aromatic hydrocarbon (PAH) and maternal prenatal urinary di-(2-ethylhexyl)-phthalate (DEHP) metabolite concentrations were associated with childhood body size at ages 5 and 7. Methods: African American and Hispanic children born in the Bronx or Northern Manhattan, whose mothers (n=702) underwent personal air monitoring for PAH during pregnancy were followed-up to age 5 and 7. DEHP metabolites were measured in spot urine samples collected from the mothers (n=424) during the third trimester of pregnancy and from the children at ages 3 and 5. Multivariable linear regression was performed to relate ambient air PAH concentrations and the molar sum of urinary DEHP metabolites to child body mass index (BMI) z-score at ages 5 (n= 422 for PAH and n=333 for DEHP analyses) and 7 (n=341 for PAH and n=288 for DEHP analyses). Results: after adjustment for confounders, compared to children of mothers in the first tertile of PAH exposure, children of mothers in the third exposure tertile had a 0.39 unit higher BMI Z-score (95% CI 0.08, 0.70) at age five, and at age seven had a 0.30 unit higher BMI Z-score (95% CI 0.01, 0.59). After adjustment for confounders, age 5 BMI z-scores were inversely associated with sum of maternal DEHP metabolites (-0.20 units per unit increase in Ln of molar sum, 95% -0.38, -0.02). The sum of maternal DEHP metabolites was not associated with BMI z-scores at age 7, but was significantly positively associated with gains in BMI z-score between ages 5 and 7. DEHP metabolite concentrations in the children at ages 3 and 5 did not predict body size, nor confound the effects of maternal concentrations on child body size. Conclusions: prenatal exposures to environmental contaminants are associated with differences in children's body size and weight gain.

Abstract Number	**S-4-13-01**
Presenter	Joel D. Schwartz*
Exposure	ambient air pollution
Health domains	cardiovascular disease
Type of research	exposure modeling

Combining Satellite Remote Sensing with Land Use Regression to Estimate Exposure to PM2.5 for Epidemiology Studies

Abstract: Satellite remote sensing provides a method of estimating PM2.5 concentrations on a daily basis at any location. Land use terms are good at capturing local sources at finer resolution than currently available from satellites. I will describe a) how these can be combined to obtain better fits than either produces and to fill in missing observations; b) the use of such estimates in both time series and cohort analyses; and c) the extension of the approach using satellite data with finer resolution. The methods all involve calibrating the satellite aerosol optical depth measurements with ground stations using generalized additive mixed models with random slopes for day. The residuals of these estimates are then regressed against local land use variables to estimate the contribution from very local sources. The combined approach shows better out of sample R2 than either singly, with 10-fold cross-validation showing R2 on the order of 0.85. Better fits are expected with finer resolution satellite data. The use of such estimates produces higher estimated effects in time series studies than central site measurements, and allows inclusion of subjects farther from monitors. Similarly, in cross-sectional and cohort studies, it eliminates selection bias from only selecting subjects near monitors. This is illustrated in studies of daily mortality, of birth weight, and of hospital admissions.

Abstract Number	**S-4-13-02**
Presenter	Michael Jerrett*, Michelle Turner, Bernardo S. Beckerman, Arden Pope, Randall V. Martin, Marc Serre, Susan M. Gapstur, Daniel Krewski, Ryan Diver, George Thurston, Aaron van Donkelaar
Exposure	others
Health domains	other
Type of research	others

Comparing Remote Sensing, Atmospheric Chemistry and Ground-based Estimates of Fine Particulate Matter on Survival

Background and Aims: Remote sensing (RS) and atmospheric transport (AT) modeling are increasingly used for exposure assessment in epidemiological and health burden studies. Here we aimed to assess whether modeled estimates of fine particulate matter from RS and AT differed from models based only on ground information in the health risks associated with exposure. Methods: We geocoded the baseline residential address of 669,047 American Cancer Society Cancer Prevention II (ACS CPS-II) Cohort subjects and assigned several exposure models to them. These estimates included a PM2.5 model based on RS (resolution ~ 9.8 km girds), an Environmental Protection Agency Hierarchical Bayesian Model (HBM) that combines atmospheric chemistry models with ground observations (~36 km), a gesotatistical kriging model based on ground observations (~ 9.8 km), a hybrid land use regression model using only ground-based inputs, and another land use regression model that combined ground-based information with the RS (<100 m) — all assigned to the geocoded point. We used Cox proportional hazards regression to examine associations with mortality from diseases of the circulatory system (plus diabetes) while controlling for likely confounders (e.g., smoking history). Follow up went from 1982 to 2004. Exposure models were averaged for the years 2002-2004. Results: Relative risks are reported over a 10 ug/m3 exposure increment. Health effects differed between the models, with the smallest risks being observed for the remote sensing models (relative risks or RR = 1.05, 95% CI: 1.03-1.07) and the EPA model (RR = 1.09, 95% CI: 1.06-1.11). Results from the geostatistical model and the hybrid land use regression that included RS information were larger and similar to each other (significant RR = 1.12). The largest risks were observed for the land use regression model that included only ground-based information and whose most significant predictor was traffic within 1 km of monitor (RR = 1.15, 95% CI: 1.13-1.18). Conclusion: Those exposure estimates using ground-based information had larger risks than either the RS or the AT models, which both predicted over relatively large areas. Smaller effects from these models may have resulted from their inability to detect fine-scale variations from emission sources such as traffic.

Abstract Number	**S-4-13-03**
Presenter	Yang Liu*, Aaron J. Cohen
Exposure	ambient air pollution
Health domains	other
Type of research	exposure modeling

Monitoring Particulate Pollution from Space: Current State of the Science

Background. Most epidemiological studies investigating the health effects of air pollutants such as PM2.5 are susceptible to exposure measurement errors because they rely on a limited number of PM2.5 monitors in their study regions. Even for the U.S. where there is a relatively extensive ground monitoring network, these exposure errors can bias risk estimates downwards and widen the confidence intervals of the estimated effects. The spatial coverage of satellite data has a natural advantage over ground point measurements. When combined with external constraints, satellite-based remote sensing of ground-level air pollution has recently emerged as a potential major contributor to solving this problem. Aims. We aim at providing an overview of the current state of the science in using satellite aerosol remote sensing data products to derive spatially resolved PM2.5 estimates. Methods. We focus on the two primary approaches that been reported in recent literature, i.e., statistical calibration models that rely on ground measurements of PM2.5 to anchor the prediction surfaces, and scaling models that use satellite observations to scale PM2.5 simulation results based on atmospheric chemistry models. Results. We will compare the spatial and temporal resolution of most recent models, geographical range of their applications, and their prediction performances Conclusion. We will provide our thoughts on where this emerging field should go in the next few years.

Abstract Number	**S-4-13-04**
Presenter	Michael Brauer*, Randall V. Martin, Aaron van Donkelaar, Dan Crouse, Sarah B. Henderson, Jiayun Yao, Richard T. Burnett, Perry Hystad
Exposure	ambient air pollution
Health domains	no health domain
Type of research	exposure measurement

Remote sensing approaches to estimate air pollution exposure for disease burden and epidemiology

Background: While the vast majority air pollution epidemiology and risk assessment relies upon ambient surface monitoring, large segments of the population live in locations that are not well-characterized by ambient monitoring networks. This is especially true in many of the world's rapidly developing economies where air pollutant concentrations are high and where the greatest risks are present. Even in developed countries with dense air monitoring networks, populations in rural areas are typically not well-represented. These populations may experience unique exposures such as those due to wildfire smoke. In these scenarios, remote sensing can provide estimates of air pollution exposure for health impact assessment or epidemiologic studies. Methods: This presentation will describe recent efforts using remote sensing for i)estimation of the global disease burden attributable to fine particles (PM2.5), ii) national and global epidemiologic analyses using remote sensing estimates of PM2.5 and NO2, including their combination with geographic predictors in a land use regression context, and iii)epidemiologic studies of wildfire smoke exposure. Results: In the Global Burden of Disease 2010, remote sensing allowed for exposure assessment to be extended to the entire global population at fine spatial resolution. Estimates were in good agreement with those derived from available surface monitoring and from a chemical transport model. In epidemiologic applications, remote sensing estimates allowed for novel analyses including rural populations. Depending upon the specific pollutant of interest, combining remote sensing estimates for different pollutants and with geographic predictors can improve exposure assessment accuracy and spatial resolution. Conclusions: Remote sensing of air pollution provides a new ability to assess exposures for large segments of the global population, especially those in developing countries and in rural areas, not previously characterized by traditional ambient monitoring approaches.

Abstract Number	**S-4-13-05**
Presenter	H. Ross Anderson*, Barbara K Butland
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	cross-sectional study

Satellite-based Estimates of Ambient Particulate Matter and Nitrogen Dioxide: Associations with World-Wide Estimates of Childhood Asthma Prevalence

Background. The availability of satellite-based estimates of ambient particulate matter with aerodynamic diameter <2.5 µm (PM2.5) and nitrogen dioxide (NO2) at a resolution of 0.1° x 0.1° provides a new opportunity to investigate associations between air pollution and asthma prevalence in areas where air pollution data are sparse. Aims. We investigated the association between satellite-based estimates of PM2.5 and NO2 and asthma prevalence in 13-14 year-old children obtained from the International Study of Asthma and Allergies in Childhood (ISAAC) in 128 centres in 28 countries. Methods. We modelled cross-sectional associations with centre-level prevalence using a two-level regression model adjusting for gross national income and sex, climate and population density. Trends in air pollution and asthma were compared between the mid-1990s and early 2000s. In a subset of centres we modelled odds ratios using a three-level logistic model. Results. The within-country estimated change in centre-level asthma prevalence per 100 children per 10% increase was -0.043 (95% CI -0.139, 0.053) for PM2.5 and 0.017 (-0.030, 0.064) for NO2. The estimated change in centre-level prevalence over time per 100 children per 10% increase in PM2.5 was -0.139 (-0.347, 0.068). Using the three-level logistic model, the odds ratio(OR) for change in centre-level prevalence per 10mcg /m3 increase in PM2.5 was 1.12 (0.97, 1.30). Conclusions. The availability of satellite-based data has enabled us to carry out the largest international study of air pollution and asthma yet described. The results are in line with existing cross-sectional evidence concerning asthma prevalence and community-level estimates of air pollution. The results for trends are novel and are coherent with the cross-sectional findings. The international character of the ISAAC data presented considerable modelling issues.

Abstract Number	**S-4-13-06**
Presenter	Mitch Klein, Xuefei Hu, Matthew Strickland, Stefanie Sarnat*, Paige Tolbert, Yang Liu
Exposure	ambient air pollution
Health domains	respiratory disease
Type of research	time series study

The Application of Satellite Remote Sensing Data in a Time Series Study of Asthma Exacerbation in Metro Atlanta

Background. PM2.5 data from central monitoring sites have served as the foundation for exposure assignment in epidemiologic studies. However, ground monitors are often clustered in urban centers and may not fully capture PM2.5 spatial contrasts over large metropolitan areas. Satellite-based estimates of PM2.5 may improve exposure assignment in large population-based health studies. Aims. Estimate associations between daily PM2.5 concentrations and asthma emergency department (ED) visits in 20-county metro Atlanta, comparing results among three PM2.5 exposure assignment approaches: central monitor, population-weighted average of multiple monitors, and spatially-resolved satellite-based estimates. Methods. Daily PM2.5 concentrations for 2001-2007 were predicted from satellite remote sensing aerosol optical depth measurements for 101 12-km grid cells over 20-county metro Atlanta. Daily asthma ED visits from hospitals in the study area were assigned to grid cells based on the ZIP code centroid of patient residence. We used Poisson generalized linear models to estimate the association between PM2.5 and asthma, controlling for grid cell, long term time trends, seasonality, and meteorology. Results. We estimated a risk ratio of 1.019 (95% CI: 1.004, 1.033) per 10 ug/m3 increase in same-day PM2.5 using grid-level satellite-based estimates. For comparison, matching to non-missing satellite measurements, we estimated risk ratios of 1.012 (95% CI: 1.002, 1.023) and 1.014 (95% CI: 1.001, 1.027) per 10 ug/m3 increase in same-day PM2.5 when using central monitor and population-weighted average PM data, respectively. Conclusion. The estimated risk ratios for the short-term effect of PM2.5 on asthma were similar among the three exposure assignment approaches. The estimated effects were slightly stronger when using spatially-resolved satellite-based PM2.5, which is suggestive of reduced exposure measurement error.