

ESTIMATING PERSONAL EXPOSURE TO INDOOR AND OUTDOOR AIR POLLUTANTS DURING SCHOOL DAY IN PRIMARY SCHOOLS

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Background and Aims: Studies that characterize personal exposure to indoor and outdoor air quality of school children have been limited. This study aimed to extend the knowledge of air quality in schools, develop methodology for estimating personal exposure to air pollutants during school day, and contribute to the current international need for further research in indoor air quality.

Methods: Four primary schools in southern England were selected for the study, in urban, suburban and rural environments. Air quality monitoring was conducted in three rounds (autumn, winter, summer) during the academic year 2009-2010. Each round involved monitoring for one week in four locations typical of children's exposure. Measurements were carried out for particulate matter count of size range 0.5-5.0 μm ($\text{PM}_{0.5-5.0}$), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), formaldehyde (HCHO), and total volatile organic compounds (tVOC). Time-activity patterns of children in schools were recorded, and used to create a representative personal exposure matrix for each child according to time spent in different environments. Statistical testing compared estimated personal exposure and measured concentrations in school classrooms.

Results: We found important differences between personal exposure and measured concentrations during the summer round in all schools, in particular for CO (t-test p-value range: 0.004-0.11), NO_2 (<0.001-0.13), HCHO in two schools (0.001-0.15), and $\text{PM}_{0.5-5.0}$ for one school (0.08-0.11). We observed no significant differences during autumn and winter rounds. Results, however, suggested an increase in the weekly variability of greater than 50% in pollutant levels for $\text{PM}_{0.5-5.0}$, NO_2 , and tVOC in three of the four schools, comparing personal exposure to measured concentrations.

Conclusions: These findings show the importance of characterization of personal exposure to indoor and outdoor air pollutants in schools. The findings provide useful methodology that will lead to better quantification of environmental exposures in children, thus strengthening the estimation of the exposure-risk association.