Size in the City

New York Pollution May Lower Birth Weight

Little pollution causes big problems. Even relatively low pollution exposures can result in smaller babies.

Current levels of environmental pollutants in New York City can adversely affect fetal development, according to a new study by a team led by Frederica Perera of Columbia University's Center for Children's Environmental Health [*EHP* **111:201–205**]. The study found a significant link between prenatal exposure to common environmental pollutants—including the combustion by-products polycyclic aromatic hydrocarbons (PAHs) and the once widely used organophosphate pesticide chlorpyrifos—and reduced birth weight and head circumference in two inner-city minority populations. (In recent years, the U.S. Environmental Protection Agency has regulated chlorpyrifos, and residential uses are being phased out.)

The researchers monitored more than 260 black and Dominican women during their pregnancies and collected biological samples from each mother and baby at delivery. During pregnancy, the mothers wore personal air monitors to gauge their exposure to eight airborne carcinogenic PAHs. The team used plasma levels of chlorpyrifos to estimate exposure to this pesticide and plasma levels of cotinine to estimate environmental tobacco smoke exposure (all of the mothers were nonsmokers). The team's approach combined use of biomarkers with epidemiologic methods. This is the first study to use prenatal personal air monitoring and biomarkers to assess the effects of these particular prenatal exposures on birth outcomes.

The team found that median exposure to chlorpyrifos during pregnancy was associated with a 4% decrease in birth weight and a 2% decrease in birth length in the overall cohort. They also found that median exposure to PAHs during pregnancy was associated with a 9% reduction in birth weight and a 2% reduction in head circumference in black newborns. No significant reductions were noted in Dominicans. In addition, the study linked prenatal exposure to chlorpyrifos with decreased birth weight and birth length in both black and Dominican infants. The mechanism for these agents' observed effects on fetal growth and development is not known. There was no significant effect correlated with environmental tobacco smoke, possibly because all the mothers are themselves nonsmokers.

In previous studies of mothers and newborns in Krakow, Poland, the researchers had found associations between these same birth outcomes and PAH exposure. However, the Polish population was exposed to 46% higher concentrations of PAHs than the present New York City cohort due to air pollution from coal burning. The fact that the New York City effects were seen at lower concentrations is of concern, according to Perera, because several studies have reported that reduction in head circumference at birth or during the first year of life correlates with lower IQ and poorer cognitive functioning and school performance in childhood.

The lack of an association between PAH exposure and adverse effects in the Dominican newborns may be due to unmeasured differences in exposure and susceptibility, the researchers speculate. The fact that birth outcomes such as weight, head circumference, and age of fetus at delivery were overall less favorable and more variable in blacks compared to Dominicans could also explain the difference. The authors are evaluating whether genetic and other susceptibility factors influence risk from these exposures. **–Julie Wakefield**

Bisphenol Aggression

Effects Shown in Mice

Although many studies have documented the adverse effects of endocrine disruptors on reproductive organs, until recently little research has been done on the influence of these chemicals on behavioral development. A new study led by Keisuke Kawai of Kyushu University evaluates the effect of fetal exposure to the estrogen mimic bisphenol A on aggression and serum testosterone concentrations in male mice [*EHP* **111:175–178**]. Bisphenol A is a monomer used to manufacture polycarbonate plastic and the resin used to line food and drink cans. It also is a component of the plastic used in dental fillings. The Japanese team found that bisphenol A, administered to pregnant mice during the early period of gestation, temporarily exaggerated aggressive behavior in male offspring. Low-dose bisphenol A also interfered with the normal development of the offspring's reproductive organs.

From gestation days 11 to 17, pregnant CD-1 mice were fed bisphenol A at doses of either 2 ng/g or 20 ng/g body weight. Their male offspring underwent aggression rating and blood sampling for testosterone at 8, 12, and 16 weeks of age. (Mice are considered to have just reached sexual maturity at age 8 weeks.) The team rated aggression according to how a male mouse acted toward an age-matched control "opponent" introduced into its cage. The scientists assessed the amount of time each test mouse spent sniffing or attacking its opponent over a 7-minute period.

At 8 weeks, males whose mothers were exposed to either concentration of bisphenol A were rated as significantly more aggressive than the control group, and the increase in aggression

Corbis

was comparable in both dose groups. At 12 and 16 weeks, however, no difference was found between the treated and control mice.

For the low-dose mice, the relative testis weight per gram of body weight at 8 and 12 weeks was significantly lower than that of the controls. The same effect was noted for the high-dose mice at 12 weeks only. Both dose groups had normal testis weight at 16 weeks. Testosterone concentration was never significantly different in treated mice compared to the controls.

Whether bisphenol A also affected reproductive organ function is unclear. However, neither relative testis weight nor testosterone concentration appeared to be related to aggressive behavior.

Perhaps more interesting is the observation that the low dose of bisphenol A seemed to have a greater effect than the higher dose on relative testis weight. Some researchers have suggested that indeed, low doses of endocrine disruptors might cause unique outcomes that will not be observed at higher doses. The mechanisms of the low-dose effects of endocrine disruptors such as bisphenol A remain unclear, and their pathway has yet to be determined. **–Julian Josephson**

Life near the Fast Lane

An Increased Risk of Birth Problems

Several recent epidemiologic studies have suggested that exposure during pregnancy to ambient air pollution—including compounds released in motor vehicle exhaust—can increase the risk of preterm birth and low birth weight. Now, investigations are beginning to examine the question of whether pregnant women residing close to heavily traveled roadways have a greater occurrence of these adverse birth outcomes. In this month's issue, Michelle Wilhelm and Beate Ritz of the School of Public Health at the University of California, Los Angeles, report that such women do indeed face greater risk of adverse birth outcomes, especially if their third trimester falls during the autumn or winter months [***EHP* 111:207–216**].

The epidemiologic case–control study involved nearly 51,000 infants born between 1994 and 1996 in 112 of the 269 zip code areas in Los Angeles County, California. These particular areas were selected because they are intersected by freeways and major arteries carrying more automobile traffic—and thus experiencing more traffic-related air pollution—than less-traveled roads. The cases included preterm infants and term low birth weight infants. The controls included term normal birth weight infants born in the same year and the same set of zip code areas.

The researchers mapped home locations for each of the cases and controls, and calculated a distance-weighted traffic density (DWTD) value for each subject as a measure of exposure to traffic-related air pollution. This measure accounts for residential proximity to roadways surrounding homes and the level of traffic on those roadways, and assumes that 96% of all motor vehicle exhaust pollutants disperse at 500 feet from the roadway. They also obtained ambient air pollution monitoring data compiled by the South Coast Air Quality Management District to assess the impact of background air pollution separately from that of traffic-related pollution. Using these covariants, Wilhelm and Ritz were able to calculate risk and odds ratios to assess the influence of roadway proximity on adverse birth outcomes.

They observed an approximately 10–20% increase in the risk of preterm birth (both normal and low birth weight infants) and the risk of term low birth weight in infants born to women living close to heavily traveled roadways. This was after controlling for measures of socioeconomic status and several other known risk factors for low birth weight and preterm birth, such as maternal age, race, and prenatal care.

The researchers found higher risks for women whose third trimester fell during the autumn and winter months. Women whose third trimester fell during the fall/winter months and who were in the highest DWTD quintile had an estimated 39% greater risk of giving birth to a term low birth weight infant and a 24% greater risk of having a preterm low birth weight infant, compared to women in the lowest DWTD quintile. No effect was found for women with spring/summer third trimesters at any DWTD level.

The researchers say these findings correlate with more stagnant air conditions present in the winter months in the Los Angeles basin. Given the weather conditions at that time of year, it is expected that pollution levels will be higher, and thus it also would be expected that women in their third trimester living close to the roadways experienced increased risk, due to the increased exposure. The biological mechanisms whereby air pollution may cause adverse birth outcomes remain to be determined. **–Ernie Hood**

Clogged arteries bad for babies. Make that *traffic* arteries—mothers living close to heavily traveled highways may be at greater risk for having preterm or low birth weight babies.

Power Photos