

Autism and Agricultural Pesticides

Integrating Data to Track Trends

The purpose of the CDC's Environmental Public Health Tracking Program is to integrate diverse data sources for surveillance and research. In a demonstration project by program grantees, a powerful convergence of data on births, social services, and agriculture allows researchers to ask highly focused questions about the relationship between environmental exposures to farm pesticides and autism spectrum disorders (ASDs) in children [*EHP* 115:1482–1489; Roberts et al.].



Data network. Combining existing birth, social service, and chemical use data in new ways may reveal new environmental connections.

The study focused on ASDs in children whose mothers lived near well-defined sites of agricultural pesticide application in the California Central Valley, a 19-county swath spanning the Sacramento and San Joaquin River valleys. The team identified 465 children born in 1996–1998 who had received ASD-related diagnoses and services. They

used state Department of Pesticide Regulation data to determine mothers' residential proximity to pesticide applications at the time they gave birth. Data from 6,975 non-ASD children whose mothers had been pregnant in the same time and region served as controls.

The group set out to examine every combination of three factors: mother's residential distance from the site of pesticide application, type of pesticide(s) applied, and stage of gestation at the time of pesticide use. Three time windows were of special interest: the period leading up to and covering central nervous system embryogenesis (1 week before conception through 7 weeks after), the period leading up to and covering neural tube development (4 days before conception through 24 days after) and overall gestation (2 weeks before conception through birth).

Because the number of possible combinations is high and the number of affected children relatively low, the study yielded only a preliminary view of how the three factors may interact. However one group of pesticides did stand out: organochlorines, including the commonly used dicofol and endosulfan, were associated with ASD out to a maternal residential distance of 1,750-meter from the site of application. Dicofol and endosulfan, which are used in the production of cotton, fruit, vegetables, beans, and nuts, account for 98% of the organochlorines applied in the Central Valley region.

Although the association between organochlorine exposure and ASDs points to a connection between the two, it does not indicate causality and does not consider other factors that may be involved. For the residences nearest to the organochlorine application sites (where the ASD association was the strongest), data around exposures came from only 8 cases and 105 controls. Of those, the focus is on the quarter who lived nearest sites where the greatest amounts of chemicals were applied. Still, the work, which used data routinely collected for other public uses, marks the need for further analysis of the relationship between organochlorines and ASDs, and lays the groundwork for asking difficult environmental health questions using available geographic, public health, and social services records. **—Victoria McGovern**

Feeling the Burn

Combustion By-Products Put Kids at Risk

One of the most extensive studies of the link between lower respiratory diseases and ambient concentrations of polycyclic aromatic hydrocarbons (PAHs), a class of widespread air pollutants, has found that the chemicals are a potent problem for preschool-age children [*EHP* 115:1510–1518; Hertz-Picciotto et al.]. The team of researchers also found that fine particles (PM_{2.5}) pose a respiratory risk to very young children.

PAHs and PM_{2.5} are generated primarily by combustion of petroleum products, coal, wood, tobacco, trash, fat, and other substances. The concentrations of PAHs and PM_{2.5} in the two Czech Republic districts studied, Prachatice and Teplice, were similar to those found in many U.S., European, and Asian cities.

The study involved 1,133 children up to age 4.5 years. The team examined pediatric charts to determine those whom a doctor had diagnosed with a lower respiratory disease of acute bronchitis, tracheitis, or laryngitis. These children were among 7,502 born from May 1994 to December 1998 who were evaluated in previous studies, providing substantial data on factors such as fuels used for home heating and cooking; birth weight; and maternal education, age at birth, and smoking history.

The current study collected information on breastfeeding, daycare attendance, and other factors that could either protect these children or increase their risk of respiratory disease. Pollution data were obtained from selected monitors in each district; readings were taken during each month anywhere from once each day to once every six days. This allowed analysis of all seasons and a wide range of intervals.

The team found a statistically significant link between bronchitis, the most commonly diagnosed illness, and elevated ambient PAHs, escalating 56% in children aged 2 to 4.5 years for each 30-day-average increase of 100 ng/m³. The increase was 29% for children under age 2 years. For each 30-day-average increase in PM_{2.5} of 25 µg/m³, bronchitis diagnoses rose 30% for children up to age 2 years. In children aged 2 to 4.5, it rose 23%. Some other pollutants that could play a role in respiratory illness, such as ozone, nitrogen oxides, sulfur dioxide, and metals, were not covered in the analysis. Certain weather variables, such as wind and humidity, also were not considered.

However, the study was strengthened by the use of a doctor's diagnosis rather than parental reports or recalled incidents, and the likelihood of a sick child visiting a doctor was very high, given that health care was free and readily available. Consistency of diagnostic coding also appeared to be very good. The strengths of the study and the magnitude of the findings lead the authors to conclude that relatively short-term exposure to ubiquitous PAHs may pose a significant respiratory threat to children. **—Bob Weinhold**

A Reason to Rethink Groups

New Approach Links PCBs, Thyroid Disruption

The production of polychlorinated biphenyls (PCBs), once widely used in electrical transformers, plastics, and other products, has been banned in the United States since the 1970s. Nevertheless, most Americans carry measurable levels of PCBs because the compounds persist in the environment and bioaccumulate. Epidemiologic studies have linked prenatal PCB exposure with impaired neurodevelopment in infants and young children, and in animal studies, prenatal exposure caused decreased levels of the thyroid hormone thyroxine (T_4). Given that thyroid hormones are essential for proper neurodevelopment, disruption of the thyroid system may be a pathway by which PCBs cause damage. New research using a novel method of grouping the chemicals now provides additional support for PCB-related thyroid disruption [*EHP* 115:1490–1496; *Chevrier et al.*].

PCBs include 209 congeners that vary based on the number and positions of chlorine atoms. These congeners have been grouped according to their potential mechanism of action (e.g., estrogenicity, antiestrogenicity, or microsomal enzyme induction). In the current study, researchers grouped congeners on the basis of their reported abilities to induce the enzymes UDP-GT, CYP1A, and CYP2B. UDP-GT has a role in T_4 elimination, and compounds that induce CYP1A and CYP2A are also likely to induce UDP-GT.

Thirty-four PCB congeners, in addition to other environmental chemicals, were measured in blood samples drawn from 285 pregnant women through the Center for the Health Assessment of Mothers and Children of Salinas, a longitudinal birth cohort study in the Salinas Valley, California. The women provided information through interviews on sociodemographic variables; alcohol, tobacco, drug, and caffeine consumption; and agricultural work history. Routine screening conducted by heel-stick blood collection yielded data on the infants' blood levels of thyroid-stimulating hormone (TSH), which is involved in the control of thyroid function.

All of the infants had TSH levels within the normal range. However, levels were significantly higher in relation to specific PCB congeners in their mothers' blood. When the researchers considered total PCB levels and PCBs grouped by structure or dioxin-like activity, they found no association. There was, however, a significant positive association between TSH levels and PCBs grouped by their ability to induce UDP-GT, CYP1A, and CYP2B. The team found that TSH increased by 29% with each 10-fold increase of such PCBs.

The researchers recommend that future studies evaluate whether any changes in neurodevelopment are associated with these PCB-related alterations in thyroid hormone levels. Their results suggest that grouping PCBs on the basis of hypothesized mechanism of action, rather than summing all congeners, may be important in understanding adverse effects of PCB exposure. —**Julia R. Barrett**

DDT and Breast Cancer Revisited

New Findings in an Old Debate

Author Rachel Carson made the initial claim in her 1962 best-seller *Silent Spring*. Subsequent studies, including a meta-analysis published in *EHP* [López-Cervantes et al. 112:207–214], downplayed the connection. Now researchers have found new evidence potentially linking DDT with breast cancer in women [*EHP* 115:1406–1414; *Cohn et al.*]. The findings come at a time when DDT is once again being promoted as a tool to combat malaria.

DDT was widely used as a pesticide in the United States and elsewhere beginning in the mid-1940s. Although DDT was highly effective in reducing the incidence of malaria, scientists began to suspect it was damaging to the environment, specifically to birds of prey in which the DDT metabolite DDE caused thinning of eggshells. Reacting to a growing fear of pesticides, some suspected a link to human cancer. In the early 1970s, DDT was banned for virtually all uses in the United States and in many other countries around the world.

Numerous chemical substitutes for DDT have been developed over the years, but few are as cheap or effective at controlling malaria as DDT. At the same time, most studies conducted since the ban have typically failed to establish a link between exposure to DDT and human cancer. Weighing the perceived health risks against the possible benefits, the WHO and other agencies have recently endorsed the indoor spraying of DDT in areas with high rates of malaria.

But the authors of the current study believe it is premature to suggest there is no link between DDT and human illness, specifically breast cancer in women. They observed that earlier studies were limited by their inability to consider subjects' age at the time of exposure or measure exposure at a young age during the time DDT was in widespread use. Based on animal studies showing that early exposure to toxicants is often most strongly associated with illness, the authors hypothesized that women who were exposed to DDT in childhood or adolescence might show a higher evidence of breast cancer than the general exposed population.

The authors analyzed the serum of women who sought obstetric care between 1959 and 1967. These women had donated blood as part of the Child Health and Development Studies. The mean age of the women was 26 years. Most would have been 4–12 years old during the period 1945–1959, when DDT was in widest use in the United States.

Researchers analyzed 129 case-control pairs, cases being defined as women subsequently diagnosed with breast cancer before age 50. The study found that high serum concentrations of *p,p'*-DDT, the primary component of DDT, predicted a fivefold increased risk of breast cancer among women who were born after 1931. Women who were born in 1931 or earlier showed no increased risk of breast cancer.

Based on these findings, the authors conclude that it is too early to decide that DDT exposure has little public health significance for breast cancer. They state that many women in the United States who were exposed to DDT in their youth have not yet reached age 50, the age above which women have the greatest risk of evidencing breast cancer. —**John Manuel**



Exposures gone by. A new study asks whether women exposed to DDT in childhood, during the height of the chemical's use in the United States, may now be at greater risk for breast cancer.