Toxic Inheritance

Fathers' Job May Mean Cancer for Kids

Exactly how cancer takes root in children remains much a mystery, despite broad investigations into the matter. Now a new study supports the idea that a father's occupation just before conception may play a role [*EHP* 109:193–198]. More specifically, the chemicals he is exposed to on the job may affect his children's health after birth, contributing to the development of nervous system tumors and, more rarely, leukemia—the two most common types of childhood cancer. The study, led by Maria Feychting of the Karolinksa Institute in Stockholm, Sweden, lends credence to the hypothesis that paternal occupational exposures may be important in the etiology of childhood cancer.

Danger in what Daddy does. A large Swedish epidemiologic study connects a father's occupation before his child's conception to a risk of the child later developing cancer.

PhotoDisc

Thanks to the combination of Sweden's unique population registry and its high-quality national cancer registry, the researchers were able to follow more than 235,000 Swedish children from birth through their early teens. The team essentially tracked all children born to married couples after two censuses in the mid-1970s and early 1980s, comparing cancer cases with paternal occupational exposures extrapolated from census information. About 522 children developed cancer, including roughly 160 cases of nervous system cancers and 160 cases of leukemia.

For each occupation represented among the fathers, two experienced industrial hygienists calculated the probability of exposure to different agents, such as pesticides, heavy metals, and solvents. The team found that the risk of nervous system cancers more than doubled among children whose fathers were exposed to pesticides, solvents, or paint products. In fact, risk tripled for children of house and industrial painters. Risk of developing leukemia also doubled among children of woodworkers. Both findings reinforce earlier studies.

The study adds to the knowledge base about a possible association between pesticides and nervous system tumors in children. It also raises new questions about some specific exposures. For instance, the study found that the risk of leukemia increased fourfold for children whose fathers were among a small sample of sheet metal workers. Curiously, leukemia risk doubled for children with fathers in government legislature and administration work, a link supported by previous studies. Some of the findings, however, contradict earlier studies. For instance, with regard to childhood leukemia, the team found no link between paternal exposures to pesticides and paint, as others had reported previously.

Feychting and her colleagues propose two causal mechanisms for the associations. First, the child may be exposed via the placenta to carcinogenic substances carried into the home by the father. Second, even before conception, the occupational exposure may cause a genetic change in the father's sperm that affects the child's cancer susceptibility. The latter is supported by earlier studies.

Aside from its sheer size, the investigation is notable as one of the first cohort studies of its kind to collect information before cancers occur in children, according to Feychting. This ensures that exposure classification is made independent of disease status, she explains. By contrast, in some prior case–control studies, recall bias potentially clouded the results because exposure information was often collected after the manifestation of disease. The study's design also eliminated the possibility of selection bias because the exposure data were derived from censuses that captured information for more than 99% of the population.

However, the study's exposure assessment weakens the results somewhat, Feychting acknowledges, because exposures were estimated based only on each father's occupational title and type of industry. Although guaranteeing that any exposure misclassification is unrelated to disease, the method leaves little room for analysis of dose–response patterns and opens the door to inaccuracies. For example, some fathers may have changed jobs at the actual time of conception. The team is now undertaking a follow-up case–control study of childhood nervous system tumors to tease out paternal exposures before birth from those during pregnancy or after birth by interviewing parents about exposures at work and home. –**Julie Wakefield**

Weathering Diarrheal Illness

Effects of El Niño in the South Pacific

In recent years, researchers have been investigating links between climate variation and diarrheal diseases. In two recent studies reported this month, Reena B. K. Singh of the Wellington School of Medicine in New Zealand and colleagues at the International Global Change Institute and the World Meteorological Organisation find a positive relationship between rising average annual temperatures associated with the El Niño climate phenomenon and diarrheal disease reports in 18 Pacific Island countries between 1986 and 1994 [*EHP* 109:155–159].

Sources of fresh water in the Pacific Islands are few. The "high islands," such as the Hawaiians, can depend on more regular rainfall because their mountain peaks cool passing clouds, wringing moisture from them. The "low island" atolls, usually arranged on doughnut-shaped coral reefs that once ringed volcanic mountains that have since eroded away, also depend on rainfall for water. But without mountains to encourage rainfall, less land mass than the high islands, and closer proximity to the ocean, they have minimal freshwater collection and storage capability and a higher likelihood of saltwater contamination during storms.

In either case, drinking water supplies in the Pacific Islands are both precious and precarious under the best of circumstances, and are growing more so all the time. Because many Pacific Islands depend on stored rainwater for drinking and hygiene, variations in rainfall and temperature affect their supplies in ways that increase the likelihood of contamination with fecal matter or bacteria or the need to resort to contaminated supplies—and contaminated water is a frequent cause of diarrheal disease. In addition, rising global sea levels and flooding from rain and high waves may also compromise supplies with both sewage from sanitation systems and saltwater, which can itself cause diarrhea.

In the first study, Singh and colleagues obtained data on Pacific Island diarrhea cases, population, land area, and precipitation rates from various sources. They then compared data on the average annual diarrhea caseload, gross national product, temperature, and water availability for the period 1986–1994. The second study used monthly reports of Fijian infant diarrhea for the years 1978–1998 along with temperature and rainfall data to generate predictions of diarrhea reports for the years 1993–1998.

The researchers found that three low-lying atoll nations—Tokelau, Tuvalu, and Kiribati—had the highest average annual temperatures, the lowest potential water availability, and the highest average rates of diarrhea during the study period. In contrast, the nation of Nauru also suffered high temperatures, yet enjoyed the lowest diarrhea rate, probably due to a more robust economy capable of paying for water purification. Analysis showed that higher gross national product was associated with lower diarrheal disease rates among all the nations studied, regardless of rainfall.

A more detailed analysis showed that low rainfall was associated with increased diarrheal disease reports in the same and following month, while high rainfall was associated only with increased diarrheal disease in the same month. The researchers suggest that low rainfall and high temperatures may contribute to simultaneous food spoilage and reduced hygiene, while high rainfall would be more likely to lead to short-term contamination from flooding followed by a period of improved water quality.

The authors conclude that improved water storage facilities, better sewerage and sanitation, and increased provision of primary health care will all be necessary to help the Pacific Islands adapt to climate changes that result in higher temperatures and changes in rainfall patterns. **–John F. Lauerman**

Home-Cooked Pesticides

Consumption Varies by Season

A traditional way to directly monitor the amount of pesticide that people eat relies on collecting and analyzing samples of duplicate meals prepared at home by study participants. New insights into this approach may make the study method even more useful to researchers [*EHP* 109:145–150]. Environmental scientist David MacIntosh of the University of Georgia at Athens and colleagues find that the duplicate meal strategy shows a seasonal variation in the average concentration of pesticide found in foods throughout the year. Moreover, the amount of pesticide ingested by an individual varies widely from sampling to sampling.

Seventy-five participants, ages 12–84 years, prepared duplicate home meals for four consecutive days. Samples of each of the four meals were blended into a composite for each person, then analyzed by gas–liquid chromatography. In 379 food samples collected during six sampling periods spaced throughout 12 months, the researchers measured seven organochlorine pesticides no longer in use but still of concern because of their persistence in the environment (including DDT), two organophosphorus insecticides commonly used in agricultural and home settings (malathion and chlorpyrifos), and one triazine herbicide (atrazine).

Three pesticides—malathion, chlorpyrifos, and *p,p´*-DDE—were detected in at least 20% of all the food samples. Depending on the time of year, average concentrations of these pesticides differed two- to threefold, with the highest concentrations detectable in spring and summer, and the lowest concentrations in the winter months. Overall, 75% of the food samples contained malathion at a mean concentration of 1.8 micrograms per kilogram (µg/kg) of food, 38% contained chlorpyrifos at a mean concentration of 0.7 µg/kg, and 21% contained *p,p´*-DDE at a mean concentration of 0.2 µg/kg. These corresponding exposure concentrations are up to 100-fold lower than safety limits set by the U.S. Environmental Protection Agency and the World Health Organization—a pleasant surprise to the researchers, who consider the amounts to present no health concerns.

Furthermore, pesticide concentrations for individuals varied from one sampling time to another. For example, for one person, chlorpyrifos concentrations ranged from nondetectable in one sample to 24 µg/kg in another. Therefore, pesticide concentrations in a single sample from an individual are not a reliable indicator of concentrations in other composite samples of their food. This is the first time that seasonal variation and individual fluctuation of dietary pesticide exposure have been reported in a study of this size.

Future researchers can obtain better information on pesticide consumption more economically by paying attention to the time of year in which samples are collected. For instance, if researchers want to capture the maximum short-term exposure to organophosphorus pesticides in the diet, they should sample in the summertime. If they're after long-term average exposure, food samples need to be monitored throughout the year.

The researchers also suggest that epidemiologists, who are concerned with the health outcomes of pesticide exposure, can use this new information in the design of future studies. Knowing that a one-time sampling does not give a reliable measure of intermediate or long-term exposure, epidemiologists can address the reliability issue by either enrolling more people in a study, obtaining repeated measurements, or making statistical adjustments to risk estimates to compensate for low reliability. **–Carol Potera**

PhotoDisc

Meal planning. Data showing that consumption of pesticides varies seasonally may help researchers design better studies in the future.