

Research Advances and Enduring Needs in Children's Environmental Health Protection

Background

Children may face disproportionate and unique threats from environmental hazards from many reasons. They may be more vulnerable than adults because their bodies are still growing and their brains, lungs, and reproductive systems are still developing. Pound for pound, children eat more, drink more, and breathe more than adults, so their exposures to environmental contaminants in food, water, or air are greater. Child-specific behaviors, such as crawling and playing on the ground also influence how and to what extent children come into contact with contaminants.

Consideration of these factors as well as non-chemical stressors and certain genetic factors is important when assessing children's risks. However, data are often lacking for children's exposures and hazards.

Research on Children's Health and Development

The U.S. government places a high priority on children's health. For example, since the 1990s, the U.S. Environmental Protection Agency (EPA) has mandated that children's aggregate exposures to multiple chemicals be explicitly considered in risk assessment. Federally-funded research is exploring where, when, and how children are exposed to chemicals and how differential exposures and susceptibilities impact risks. Exposure research is designed to understand (1) product use patterns, (2) spatial/temporal variability in contaminant levels, (3) activity patterns and routes of exposure, (4) biomarker/exposure estimates, and (5) exposure modeling tools. Recent studies provide information about exposures associated with consumer products (pesticides, cleansers), furnishing (PFCs, PBDEs, phthalates) and combustion (PAHs).

Since 1998, the U.S. Environmental Protection Agency (EPA) and the National Institutes of Environmental Health Sciences (NIEHS) have partnered to fund the Centers for Children's Environmental Health and Disease Prevention Program. These centers are examining interactions between key environmental exposures and a range of child prevalent diseases including asthma and respiratory health and neurodevelopmental disorders such as autism. New findings include evidence for gene-environment interactions which help explain why some children react more to a chemical than others. With a common goal of preventing and reducing childhood diseases, these Centers translate the information to affected communities and the broader public.

In 2009, the National Institutes of Health (NIH) launched the National Children's Study in partnership with Centers for Disease Control and Prevention (CDC), EPA, and NIEHS. Here, researchers will recruit and track 100,000 children from before birth to adulthood, gathering both exposure and health outcome information and will evaluate how early life exposures may affect their subsequent health. After eight years of planning, the Study began the enrollment and data collection processes in 2009. Study researchers will sample air, house dust, water, soil, and food during the mother's pregnancy and the child's early life. Researchers will obtain biospecimens such as urine, saliva, vaginal fluids, blood, breast milk, meconium, and cord blood to analyze for biomarkers of exposures and biomarkers of effects. Contaminants of concern include heavy metals, volatile organic compounds, carbonyls, semi-volatile organic compounds, disinfection byproducts, dioxin, polychlorinated biphenyls, pesticides, and

persistent organic pollutants. Findings from this research will provide researchers, public health officials, risk assessors, and health care providers with information from which to develop prevention strategies, health and safety guidelines and possibly new treatments and cures for disease.

Gaps in Knowledge

In order to protect children, we need more information about age-specific exposures and critical windows for disrupting development. A huge challenge is to consider the cumulative risks of simultaneous exposures to multiple chemicals and other stressors in real world settings. Research that fills these data gaps will reduce uncertainties in risk assessment. In the long term, results from the National Children's Study and the Children's Centers will inform policies that eliminate exposure sources and prevent risks.