



EXPRESS STATEMENT

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

*Revised by the leadership of the SOT Occupational and Public Health Specialty Section
in January 2017*

Background

Children may face disproportionate and unique threats from environmental hazards due to 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, and 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 US government places a high priority on children's health. For example, since the 1990s, the US Environmental Protection Agency (US 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).

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Since 1998, the US EPA and the National Institute 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 impacted communities and the broader public.

In 2009, the National Institutes of Health (NIH) announced the National Children's Study in partnership with the US Centers for Disease Control and Prevention (US CDC), US EPA, and NIEHS. Investigators planned to follow 100,000 children from before birth to adulthood, gathering both exposure and health-outcome information to assess the impact of early-life exposures on subsequent health. Study researchers originally planned to sample air, house dust, water, soil, and food during the mother's pregnancy and the child's early life. Researchers also planned to obtain biospecimens, such as urine, saliva, vaginal fluids, blood, breast milk, meconium, and cord blood to analyze them for biomarkers of exposures and biomarkers of effects. Contaminants of concern include heavy metals, volatile organic compounds, carbonyls, semivolatile organic compounds, disinfection byproducts, dioxin, polychlorinated biphenyls, pesticides, and persistent organic pollutants. The Vanguard Study was a pilot effort designed to evaluate test methods and model study approaches before beginning the Main Study. Although the Vanguard Study generated data and publications, it did not provide a feasible model for use in the Main Study. For this reason, the launch of the Main Study was marked for closure in 2014 by Francis S. Collins, MD, PhD, the NIH director.

The demise of the Children's Health Study did not significantly hamper efforts to safeguard the health of children, as work continues at NIH study partners the US EPA, NIEHS, and US CDC. In 2015, the US EPA released the "Children's Environmental Health Research Roadmap," which delineated its vision of agency decision-making guided by innovative science. Also in 2015, the NIH funded several child-centric initiatives: the NIEHS-led Children's Health Exposure Analysis Resource (CHEAR), a National Toxicology Program (NTP) and National Center for Advancing Translational Sciences (NCATS) joint effort in developmental toxicology tools for use in Tox21 predictive toxicology, and supplemental funding for existing programs that characterize the adverse impact of environmental exposures. Findings from this research will provide researchers, public health officials, risk assessors, and healthcare providers with information from which to develop prevention strategies, health and safety guidelines, and possibly new treatments and cures for disease.

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Gaps in Knowledge

To protect children, more information is needed 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 these efforts will inform policies that eliminate exposure sources and prevent risks.

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