



A M S P D C

Children's Environmental Health

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With rising incidence rates reported for asthma, birth defects, neurodevelopmental disorders, obesity, type 2 diabetes, and preterm birth,¹⁻⁵ there has been a concomitant increase in the recognition of the importance of toxic chemicals in our environment.⁶⁻¹⁰ In 1993, the National Academy of Sciences published a landmark report, *Pesticides in the Diets of Infants and Children*,¹¹ which emphasized that children are both more exposed and particularly vulnerable. Exposures in utero and in the first few years of life have disproportionate effects.^{12,13} Relative to their body weight, children breathe more air, drink more water, and eat more food than adults.¹⁴ Children are closer to the ground, play vigorously outdoors, and their higher body surface to volume ratio and normal hand to mouth behavior increase their exposure.¹⁵ Young children have immature immune systems and may be less able to metabolize toxicants or ameliorate the potential effects of carcinogens, including ionizing radiation.¹⁶ Malignancies, cardiovascular, and neurodegenerative diseases may take decades to develop, so young children have the longest lifetime for consequences of early exposures to become apparent.¹⁷ The growing appreciation of epigenetics raises concerns that environmental exposures may affect not just today's children, but also our children's children.¹⁸ Our understanding of the complexities of the relationships between the environment and children's health should significantly increase with the full implementation of The National Children's Study, a broad-ranging 21-year prospective study designed to improve our ability to assess, prevent, and treat adverse effects of environmental exposures.¹⁹ The field of children's environmental health is growing worldwide,²⁰⁻²³ and the World Health Organization recognizes the need for more research.²⁴ Understanding the relationship between global climate change and health promises to be an important focus well into the future.^{25,26}

Education of Physicians in Children's Environmental Health

The Institute of Medicine has recommended that environmental health should be part of medical education at all levels,²⁷ and several governmental and non-governmental efforts have addressed this need. The not-for-profit Children's Environmental Health Network began such efforts in the

early 1990s.²⁸ The Agency for Toxic Substances and Disease Registry (ATSDR), a part of the Centers for Disease Control and Prevention, organized a national child health initiative in 1996 that focused the agency's physician education efforts.²⁹⁻³² In 1997, the US Environmental Protection Agency (EPA) formed an Office of Children's Health and the White House launched a multi-agency Task Force on Children's Environmental Health Risks and Safety Risks.^{33,34} Government agencies have collaborated with the American Academy of Pediatrics, Children's Environmental Health Network, and a variety of non-governmental organizations to develop quality educational materials for healthcare providers. Nonetheless education remains spotty.^{35,36} Few pediatricians are adequately trained or experienced in interpreting the avalanche of information about potential environmental challenges.^{37,38} Pediatricians need to incorporate an environmental history into their practices and perform age-appropriate risk assessment. And when a potential environmental disease trigger is identified, what then? Parents will increasingly seek competent guidance, and pediatricians need advice from experts in children's environmental health. Fortunately, resources are becoming increasingly available, including a clinician's handbook published by the American Academy of Pediatrics, *Pediatric Environmental Health*, now in its third edition.³⁹ Grand rounds, seminars, webinars, and government reports continue to proliferate, and the fund of knowledge is steadily growing. A new textbook on children's environmental health, edited by Philip Landrigan and Ruth Etzel, is scheduled for publication (personal communication with Philip J. Landrigan, June 2012).

Training Programs in Children's Environmental Health

A small number of pediatricians are developing a special focus on "Environmental Pediatrics" or "Children's Environmental Health." Perhaps the most ambitious educational funding was a program launched in 2001 by the Ambulatory Pediatric Association, encouraging formal 3-year fellowships at 5 academic medical centers: Boston Children's Hospital, Mount Sinai School of Medicine, George Washington

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| ATSDR | Agency for Toxic Substances and Disease Registry |
| EPA | Environmental Protection Agency |
| PEHSU | Pediatric Environmental Health Specialty Unit |

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Table. Fellowships in children's environmental health

| Program | Hospital and Academic Affiliation | Location |
|---|--|---|
| Environmental Health Environmental Pediatrics | Boston Children's Hospital and Harvard Medical School Mt. Sinai Medical Center and School of Medicine | Boston, Massachusetts New York, New York |
| Fellowship in Child and Adolescent Health Research with a focus on Children's Environmental Health | Cincinnati Children's Hospital and University of Cincinnati | Cincinnati, Ohio |
| General Pediatric Fellowship with Pediatric Environmental Health Option | University of California, San Francisco | San Francisco, California |
| American Academy of Pediatrics Pediatric Environmental Health and Food Policy Fellow | American Academy of Pediatrics | Washington, District of Columbia |
| Pediatric Environmental Health Sciences Fellowship General Academic Pediatric Fellowship with focus on Environmental Health | Medical College of Wisconsin University of Washington | Milwaukee, Wisconsin Seattle, Washington |

University, University of Cincinnati, and University of Washington. Twenty-seven competencies for fellows in pediatric environmental health were proposed.⁴⁰ In the first 5 years, 17 fellows had entered these programs, most of whom successfully completed their training and took their places as leaders of this nascent subspecialty.⁴¹ The Ambulatory Pediatric Association continues to be active in this regard and plans to start accrediting fellowships in Children's Environmental Health. A list of current training programs is in the [Table](#).

Children's Environmental Health Centers

Children's Environmental Health Centers have sprung up throughout the US and beyond.^{42,43} ATSDR's Child Health Initiative launched a national network of Pediatric Environmental Health Specialty Unit (PEHSU), funded jointly by ATSDR and the EPA.⁴⁴ PEHSU are clinical facilities that operate collaboratively between academic pediatric programs and clinics certified by the Association of Occupational and Environmental Clinics, offering consultative, educational, and referral services to clinicians and communities. At least 1 PEHSU operates in each of 10 federally defined regions in the US, Canada, and Mexico, and several other countries outside North America (information available at http://www.aoec.org/pehsu/documents/pehsu_program_overview_december_2011.pdf). In addition, Children's Environmental Health and Disease Prevention Research Centers,⁴⁵ jointly supported since 1998 by the National Institute of Environmental Health Sciences and the EPA, are located at 14 sites as of 2011 (information available at <http://www.niehs.nih.gov/research/supported/centers/prevention/grantees/index.cfm>).

It is no longer possible to open up a newspaper (or social media feed), without reading about another environmental concern for children—climate change, hydraulic fracturing, tsunamis, wild fires, metals in jewelry, excess medical radiation, flame-retardants, endocrine disruptors, fetal alcohol exposure, air pollution, and first-hand, second-hand, and now third-hand tobacco smoke.⁴⁶ One important function of children's environmental health centers is to dispassionately interpret the news for anxious parents, families, healthcare providers, governments, and the community. Pediatricians

have a unique and vital role in the development of national and international policies meant to balance the risks and benefits of chemicals in the environment.⁴⁷

Should Children's Environmental Health Be a Board-Certified Subspecialty?

Pediatricians drawn to the field hail from a wide variety of backgrounds, including teratology, lead poisoning, poison control, community health, neonatology, and pediatric pulmonology. Although there is a clear and compelling need for experts in this field to teach medical students, residents, and other health professionals, is further subspecialization of pediatrics desirable? No one can turn back the clock, but subdividing into smaller and smaller pieces raises concern for the future of general pediatrics, which is, after all, already a specialty. Thoughtful commentaries have been written lamenting the loss of the Oslerian tradition of the general physician caring for the "whole person" and the inevitable loss of this role model for young physicians.^{48,49} There is a distinct difference between the time-honored tradition of physicians becoming absorbed in a certain segment of medical science and developing expertise in that area and the need for official certification by the American Board of Medical Specialties.⁵⁰ Children's Environmental Health may not warrant board certification, but experts certainly are needed. Pediatricians interested in developing expertise should be encouraged to pursue advanced public health degrees (MPH and DPH), which often can be obtained before, during, or after medical school, pediatric residency, or subspecialty fellowship. Academic departments will surely seek out pediatricians with expertise as they incorporate Children's Environmental Health into their curricula. ■

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