

## Editorial

# Environmental Pediatrics and the Ecological Imperative

The major diseases confronting children of developed nations today are chronic illnesses of multifactorial origin, reflecting the increasingly urban-industrialized ecosystems in which pre- and post-natal development take place. These include asthma, which has doubled in frequency since 1980; birth defects, which remain the leading cause of infant death; developmental disorders, such as attention deficit/hyperactivity disorder and autism; and childhood leukemia and brain cancer, which have increased in incidence since the 1970s. Genetic factors appear to be responsible for causation of 10%–20% of cases of chronic disease in children, but most of the remainder are thought to result from interactions among multiple genetic and extragenetic factors including diet, lifestyle, and environmental exposures. Evidence is increasing that exposures to toxic chemicals in the environment contribute significantly to causation of chronic disease in children. Children today are at risk of exposure to many thousands of synthetic chemicals, nearly all of them newly developed since World War II. They are especially likely to be exposed to the thousands of high-production volume (HPV) chemicals—defined in the United States as those manufactured in or imported into the country in quantities exceeding 1 million pounds per year—that are the chemicals most widely distributed in the environment. Of great concern is the fact that only about half of HPV chemicals have ever been tested for their potential to cause toxicity, and fewer than 20% for their capacity to interfere with children's development.

Recognition has become widespread in the pediatric as well as the public policy communities that children are generally more susceptible to environmental exposures than adults. Environmental pediatrics, the study of the impact of environmental factors on children's health, has in the past 5 years become an increasingly important and visible com-

ponent of pediatric research and practice. National conferences have been held on the impact of environmental toxins on the health of children. Journals have devoted entire issues to topics in children's environmental health. A national network of children's environmental health research centers, and a parallel network of clinically oriented Pediatric Environmental Health Specialty Units (PEHSUs) have been established in the United States. A new national fellowship training program in environmental pediatrics has been created. The American Academy of Pediatrics has published a *Handbook of Pediatric Environmental Health*, the "Green Book," now in its second edition.

A critically important intellectual step in the development of environmental pediatrics was the recognition that environmental toxins can exert a range of adverse effects in children—some of these effects are clinically evident, but many can be discerned only through special testing and are not evident on the standard examination, hence the term "subclinical toxicity." The underlying concept is that there exists a dose-dependent continuum of toxic effects, in which clinically obvious effects have their subclinical counterparts. The concept of subclinical toxicity traces its origins to pioneering studies of lead toxicity in clinically asymptomatic children undertaken by Herbert Needleman and his colleagues. Needleman et al. showed that children's exposure to lead could cause decreases in intelligence and alteration of behavior even in the absence of clinically visible symptoms of lead toxicity. The subclinical toxicity of lead in children has subsequently been confirmed in prospective epidemiologic studies. Similar subclinical neurotoxic effects have been documented in children exposed in utero to polychlorinated biphenyls (PCBs) and methyl mercury.

With the growing recognition in the past decade of the unique vulnerability of infants and children to environ-

mental toxins and the economic costs demonstrated by studies such as that of Davies et al. in this issue of *Eco-Health*, research investment in environmental pediatrics has increased substantially. However, critical questions in children's environmental health remain unanswered. These include:

- The contribution of indoor and ambient air pollution to the origins of asthma.
- Environmental causes of developmental disabilities in children. The U.S. National Academy of Sciences has recently concluded that as many as 28% of all neurodevelopmental disabilities are of environmental origin, but many of the specific exposures responsible have yet to be identified.
- Effects of endocrine disruptors (EDs). Although there has been such speculation about the possible contributions of EDs to such trends as the increasing incidence of hypospadias, increasing incidence of testicular cancer in young men, and premature onset of puberty in girls, actual human data are scant and badly needed.
- Causes of the rising incidence of certain pediatric cancers. For example, glioma, the second most common malignancy in children, has increased in reported incidence by nearly 40% since 1972, but the causes are not known.

Prevention of diseases of environmental origin in children will depend upon application of knowledge gained through research coupled with legislative, regulatory, and educational initiatives. Among those in the U.S. are the following:

- Legislation. Passage of a Children's Environmental Health Act at the federal level and passage of Children's Environmental Protection Acts and School Environmental Protection Acts in the states will lead to establishment of a wide variety of programs for prevention and education.
- Enhanced pre-market toxicity testing of chemicals. A major need is to strengthen legal requirements for pre-market toxicity testing of chemicals. The federal statute that mandates such testing, the Toxic Substances Control Act (TSCA), is insufficiently enforced. Currently, chemicals are presumed to cause no harm until toxicity is definitively proven. This assignment of burden of proof is not protective of children's health, and it needs to be reversed.

- Right-to-know. Education is a powerful strategy for disease prevention. It complements and extends legal and regulatory efforts. Educational efforts will need to be directed at pediatricians as well as patients and the public.
- Precautionary principle. Broad-based consideration of the prevention principle (a.k.a. the precautionary principle) as a philosophic approach to exposure prevention would complement current approaches to risk assessment and improve public health.

As a consequence of the increasing involvement of WHO, international efforts in children's environmental health are expanding. These include: developing global training programs, establishing an Office in Children's Environmental Health at the World Health Organization, broad education of pediatricians worldwide, and growing commitment of national governments and international agencies to reducing children's exposures to environmental toxins.

Environmental pediatrics has risen to importance in parallel with two developments in the past 50 years: (1) the conquest in the industrialized nations of the major infectious diseases and their replacement by chronic conditions as the major causes of illness and death in children; and (2) the growing understanding that chemicals in the environment are responsible at least in part for these changes in patterns of disease. The challenge now is to better elucidate the impact of chemical substances on patterns of health and disease in children, to design evidence-based approaches to the treatment and prevention of childhood disease of environmental origin, and to identify the environmental pathways and sources of exposure using an ecosystem approach.

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