Introduction to Children’s Health and the Environment

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The New Pediatric Morbidity

Chronic diseases are the principal causes of illness, hospitalization and death among children in industrially developed nations

- Asthma
- Cancer
- Birth defects
- Neurodevelopmental disorders
- Obesity
Incidence of Childhood Brain Cancer 1975–2004

US Incidence of Testicular Cancer

*Age-adjusted to the 1970 U.S. standard population.

Developmental Disabilities

- Affect 3-8% of all children
- Include: Dyslexia
  ADHD
  Mental Retardation
  Autism
- Possibly increasing in incidence
Overweight and Obesity

- Prevalence has nearly quadrupled in American children
- 2.5-fold increased risk of overall mortality
- 4-fold risk of cardiovascular mortality
- 5-fold risk of diabetes
- Risk of hypertension, gall bladder disease, and some cancers


The Central Question in Pediatric Environmental Health Research:

What is the Evidence that Chemical Toxicants in the Environment Contribute to Causation of Chronic Disease in Children?
Children’s Health and Environmental Toxicants: What We Know

- Children are surrounded by a large and ever increasing number of chemicals.
- Many of the chemicals to which children are at risk of exposure have not been tested for their possible developmental toxicity.
- Children are more heavily exposed and more vulnerable to many environmental chemicals than adults.

Children today are exposed to thousands of synthetic chemicals. Most have not been tested for toxicity.

- 80,000 + chemicals in commerce
- Most invented in the past 30-40 years
- 3,000 are high production volume chemicals
- No basic toxicity information is publicly available for nearly half of HPV chemicals
- Information on developmental toxicity is available for less than 20% of HPV chemicals
- Many HPV chemicals are detectable in adult blood, breast milk and infant cord blood.
Why Children Are Especially Vulnerable to Environmental Toxicants

- Greater exposure proportionate to body mass—7 times more water per Kg per day; Hand-to-mouth activity
- Diminished ability to detoxify many chemicals
- Heightened biological vulnerability – thalidomide, DES, fetal alcohol syndrome
- More years of future life

*National Academy of Sciences, 1993*

Evidence is Increasing that Toxic Chemicals in the Environment Contribute to Causation of Disease in Children
Evidence for Environmental Causation of Asthma

- Known indoor triggers include house dust, second-hand tobacco smoke, mold and mildew, cockroach droppings, certain pesticides
- Ambient air pollution – ozone and particulates. *The story of the Atlanta Olympic games*
- Genetic susceptibility is important and candidate genes have been identified
- Prevention works and is turning the tide. It includes community-wide education, aggressive treatment, smoking cessation, air pollution prevention, and improvements in housing quality

Air Pollution and Asthma

*New York City, before and after a photochemical smog.*
Evidence for Environmental Causation of Childhood Cancer

- Radiation
- Solvents, especially benzene
- Parental employment in industries that use solvents – painting and printing
- Pesticide exposure, especially prenatally

Evidence for Environmental Causation of Male Reproductive Disorders

- Falling sperm counts – cause not known
- Rising testicular cancer – cause not known
- Increasing hypospadias – cause not known

*Are Endocrine Disrupting Chemicals Responsible? Not known.*
Evidence for Environmental Causation of Neurodevelopmental Disorders

- Lead
- Methyl Mercury
- Polychlorinated Biphenyls (PCBs)
- Organophosphate Pesticides
- Arsenic
- Manganese
- Others?

Are there additional developmental neurotoxicants?

![Chemicals known to be toxic to human neurodevelopment](#)
- Chemicals known to be neurotoxic in human beings
- Chemicals known to be toxic in experiments
- Chemical universe

n=80,000
n>1,000
n=201
n=5
Neurodevelopmental disability is not limited to clinically obvious conditions.

It also includes an entire spectrum of diminished function, termed subclinical toxicity.

Widespread subclinical neurotoxicity can affect the health, well-being, intelligence and even the security of an entire nation.
Lead and Behavior – Lead Affects more than Intelligence

- At age 7, Needleman et al. found a borderline association between teachers’ ratings for aggression, delinquency, social problems and lead levels.
- By age 11, increased delinquent and aggressive behavior were clearly evident in children with higher lead levels.
- By age 18, young adults with higher lead levels at age 7 were more likely to be dyslexic and to have quit school.

Widespread Neurotoxicity May Jeopardize National Security
Disease of Toxic Environmental Origin in Children Is Extremely Costly

### Estimated Total Costs of Pediatric Disease of Environmental Origin

<table>
<thead>
<tr>
<th>Disease</th>
<th>Best Estimate</th>
<th>Low Estimate</th>
<th>High Estimate</th>
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</thead>
<tbody>
<tr>
<td>Lead Poisoning</td>
<td>$43.4 billion</td>
<td>$43.4 billion</td>
<td>$43.4 billion</td>
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<tr>
<td>Asthma</td>
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<tr>
<td>Cancer</td>
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<td>Neurobehavioral Disorders</td>
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<td>$18.4 billion</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>$48.8 billion</strong></td>
<td><strong>$64.8 billion</strong></td>
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</tbody>
</table>
The Solution

Progress Against Disease of Environmental Origin in Children Will Require Work in These Areas

- Testing chemicals for toxicity
- Disease tracking
- Research
- Training of health care providers
- Patient care
- Prevention

Research: The National Children’s Study

http://www.nationalchildrensstudy.gov/
Thank You!

Protecting Children against
Environmental Threats to Health