Little Things Matter

The Impact of Toxins on the Developing Brain

Bruce Lanphear, MD, MPH
Child & Family Research Institute, BC Children’s Hospital
Faculty of Health Sciences, Simon Fraser University
Children’s Centers’ Annual Meeting, October 31, 2015
Brain-based Disorders in Children

The Rise of Autism

Factors that Impact Brain Development

- Sex
- Nutrition
- Preterm Birth
- Social Stressors
- Built Environment
- Maternal Depression
- Genetic Susceptibility
- Preschool Attendance
- Environmental Toxins
US Expenditures on Autism Research

$1 billion

Genes

$40 million

Environment

Genes or Environment?

Genes

Environment
Genes or Environment?

Genes
- Rett’s Syndrome

Genes and Environment
- Autism
- ADHD
- Depression

Environment
- TBI
Genes or Environment?

- Genes
- Genes and Environment
- Environment

Genes:
- Rett’s Syndrome

Genes and Environment:
- Autism
- ADHD
- Depression

Environment:
- TBI

COMPLEX
“If causes can be removed, then susceptibility ceases to matter.”

Geoffrey Rose, MD
Environmental Disasters
... are just the tip of the iceberg
Vulnerability of the Developing Brain

- The blood brain barrier isn’t fully formed; it is more permeable to toxins
- Rapidly growing cells are often more vulnerable to toxins than slowly growing cells
- Brain growth occurs over a longer duration than other organs
- The fetus and child may lack enzymes to detoxify contaminants
- Young children often more heavily exposed to contaminants than older children and adults
NO ACCEPTABLE LEVEL?
Cardiovascular Disease Mortality by Cigarette Smoke (PM$_{2.5}$)

Benzene and Leukemia

Tobacco Exposure and Birthweight

ETS Ban
ETS Ban

15% Reduction PTB

Impact of Lead on PTB

OR=1.9

10x OPs
-151 grams

-0.5 week

The Prevention Paradox

The majority of disease and disability occurs in those who are at low to moderate risk
The Prevention Paradox

Estimated Loss of IQ in US Children at Different Intervals of Blood Lead

Current Reference Value = 5 µg/dl

- 0.5 Million
  - 5.7 Million
  - 6.4 Million
  - 12.7 Million

- 2.10 µg/dl
  - 1.6 Million
  - 9.3 Million

- 1.43 µg/dl
  - 0.9 Million
  - 5.7 Million
  - 4.7 Million

No. of Children in Distribution x IQ Loss Average = Estimated IQ Points Lost

Using the current reference value of 5 g/dl we will only protect 3.1 million IQ points (about 18% of the total). Adapted from Bellinger D. EHP 2011;120:501-507.
$1 = $17 to $220

What is the cost-benefit ratio for childhood vaccines?
$1 = $16.5

Environmental: $46%
Clinical: 16%
Non-clinical person-directed: 13%

PANDEMIC OF CONSUMPTION
Time to Give Prevention a Chance?
Lessons from the FDA
If we didn’t evolve with it ... avoid it.
How to Avoid Exposures to Toxins

• Eat fresh, organic and unpackaged foods; avoid canned foods

• Minimize use of pesticides around the home

• Avoid cosmetics, fingernail polish and lotions

• Support bans on smoking in public places and cosmetic pesticides

• Support efforts to update chemical management policies and reduce industrial pollutants
Organic to Conventional Yield Ratios

“We can’t live in a state of perpetual doubt, so we make up the best story possible and we live as if the story were true.”

Daniel Kahneman