The Pediatric Environmental Health Toolkit

Training Program for Health Care Providers
What We Will Cover

• Background on pediatricians’ current practices related to environmental health

• The unique vulnerabilities of children

• The development of the Pediatric Toolkit

• Case studies on environmental exposures

• How to use the Toolkit to address these issues
Parental Concern vs. Pediatrician Advice

- ear infections
- immunization
- television
- car accidents
- eating right
- env. toxins

- Pediatrician advises often
- Parents worry "a lot"

Stickler GB, Simmons PS., Clin Pediatr 1995
The Environmental History in Pediatric Practice: A Study of Pediatricians’ Attitudes, Beliefs, and Practices

• Fewer than 20% report training in environmental history taking.

• Strongly believe in importance of environmental exposures to children’s health. (53.5% had patient seriously affected)

• Lack confidence in environmental history-taking, and in discussing environmental exposures with patients.

Preferred resources: AAP patient education materials, newsletters
The Chemical Environment

• > 82,000 synthetic chemicals on EPA inventory of chemicals manufactured in U.S. today

• Most first synthesized in the past 50 years

• ~ 700 new chemicals introduced each year

• Few chemicals tested for basic toxicity
Unique Susceptibilities of Children

• Exploratory behavior
• Crawling
• Hand to mouth activity
• Restricted diet
• Teens – work, hobbies, high risk behaviors

Children differ physiologically:
• Still growing and developing
• Absorption, metabolism, & elimination different
• Blood-brain barrier still forming in young infants
Increased Exposure from Inhalation and Dermal Absorption

Increased metabolic rate

Higher minute ventilation
- Newborn 400 ml/min/kg
- Adult 150 ml/min/kg

Roughly double the surface area to body wt.
- Increased absorption from dermal route

Breathing Rates by Age Group

Miller M et al., Intl J Tox 2002

Pediatric Environmental Health Toolkit 2006
Greater Boston and San Francisco Bay Area Physicians for Social Responsibility, UCSF Pediatric Environmental Health Specialty Unit
Mean Water Intake

Miller M et al., Intl J.Tox  2002

Greater Boston and San Francisco Bay Area Physicians for Social Responsibility, UCSF Pediatric Environmental Health Specialty Unit
The Pediatric Environmental Health Toolkit

• Developed to enable pediatric and family care providers to routinely include, in well-child visits, information on preventing toxic exposures.

• The “Toolkit” includes visually exciting and creative materials that have been designed for easy use by practitioners.
Toolkit Development in Brief

• Demand for concise materials – Green Book “Cliff Notes”

• Developed by PSR, local American Academy of Pediatrics (AAP) chapters (Northern CA and MA), University of California San Francisco Pediatric Environmental Health Specialty Unity (UCSF PEHSU)

• Pilot tested in CA and MA

• Training Programs in 5 States funded by the EPA

• Endorsed by the AAP
Toolkit Provider Materials
Rx for Prevention

- **Have a Healthy Home.** Keep your house well-ventilated, free of dust and tobacco smoke. Choose safer alternatives for cleaning and home renovation, such as water-based glues or paints, and citrus-based solvents. Avoid spraying pesticides in the home, garden, and on pets. Get rid of standing water that helps breed insects. Repair drips and holes. Clean up food crumbs and spills and put away all food that will attract unwanted insects or animals.

- **Don’t Get Burned.** Enjoy the sun safely. Protect your child from excessive sun exposure with hats and cover-ups. Use sunscreen (SPF 15 or higher) once your child is 6 months old. Do NOT use sunscreens combined with the pesticide DEET or other insect repellent. Watch for the "UV Index" that provides guidance on sun exposure, on local weather forecasts in your area. Children can get sunburned even on cloudy winter days.

Find out more: www.igc.org/psr

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**Tip: Don’t Get Burned!**

Protect your child from harmful rays with hats, sunscreen (SPF 15 or higher), clothing and cover-ups.

Find out more: www.igc.org/psr
Organic Diet Reduces Exposure to Common Agricultural Pesticides

- 23 children monitored for metabolites before/after organic diet
- Levels of urinary metabolites reduced to non-detectable for chlorpyrifos and malathion
- Again elevated on re-introduction of conventional diet

Advice for Buying Organic

Pesticide Report Card

<table>
<thead>
<tr>
<th>Highest in Pesticides</th>
<th>Lowest in Pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>Asparagus</td>
</tr>
<tr>
<td>Bell Peppers</td>
<td>Kiwi</td>
</tr>
<tr>
<td>Celery</td>
<td>Avocados</td>
</tr>
<tr>
<td>Cherries</td>
<td>Mangos</td>
</tr>
<tr>
<td>Grapes (imported)</td>
<td>Bananas</td>
</tr>
<tr>
<td>Nectarines</td>
<td>Onions</td>
</tr>
<tr>
<td>Peaches</td>
<td>Broccoli</td>
</tr>
<tr>
<td>Pears</td>
<td>Papaya</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Cauliflower</td>
</tr>
<tr>
<td>Red Raspberries</td>
<td>Pineapples</td>
</tr>
<tr>
<td>Spinach</td>
<td>Corn (sweet)</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Peas (sweet)</td>
</tr>
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This wallet guide brought to you by:

Environmental Working Group
www.ewg.org
Chemical Exposure Case Examples

Actual Cases of Toxic Metal Exposure including Arsenic and Lead
Case 1 -
Family with Unexplained Symptoms

Family (all 8 members/2 children) develops recurring neurologic and medical illness over four years, worse in winter

- Fatigue, rashes, seasonal alopecia
- Recurrent severe respiratory infections
- Debilitating headaches, malaise
- Severe recurrent nosebleeds
- Both children have “grand mal” seizures and hyperesthesias
- Fish and houseplants have died

Peters HA, Croft WA, Woolson EA, Darcey BA, Olson MA., JAMA 1984
### Environmental History

- **Activities** – school, daycare, after school, sports, grandparents, church, etc.
- **Community** – industry, agriculture, dump site, water pollution, water source
- **Household** – dwelling, age, condition, heating sources, pesticides use, SHS
- **Hobbies** – arts, crafts, fishing
- **Occupation** – known exposures, fumes, dusts, vapors, Material Safety Data Sheets
- **Oral behaviors** – pica/mouthing
Case 1 – continued

Unexplained Symptoms

• Family used recycled “old” wood in their stove
  - Chromated Copper Arsenate (CCA) treated wood
  - Stove ashes with > 1,000 ppm arsenic contaminated living area

• CCA – commonly used wood preservative (decks, playground equipment etc.) **No longer produced for residential use.**

• Arsenic – anti-metabolite, interferes with ATP cycle. Known human carcinogen

Kwon E. et al EHP 2004
# Advice for Patients & Providers

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### Arsenic

<table>
<thead>
<tr>
<th>Topic</th>
<th>Health Effects Summary</th>
<th>Sources and Routes of Exposure</th>
<th>Prevention Strategies</th>
</tr>
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<tbody>
<tr>
<td><strong>Arsenic</strong></td>
<td>Acute high dose exposures can cause nausea, vomiting, hematemesis, diarrhea, abdominal cramping, and shock. Lower dose exposures can cause GI upset followed by a more protracted course of bone marrow suppression, hepatic dysfunction, myocardial depression with cardiac conduction disturbances, and a peripheral sensimotor neuropathy that can mimic Guillain-Barre Syndrome. Chronic exposures produce fatigue, malaise, and low-grade bone marrow depression. Skin changes include Mee’s lines (white, transverse creases across fingernails), hyperkeratotic, hyperpigmentation, and eczematoid eruptions. Chronic exposure is also associated with heart disease, peripheral neuropathy (parathesias, pain, ataxia). Arsenic is also a known carcinogen with dose-response increases in bladder, lung, and skin cancer as well as link with acute myelogenous leukemia.</td>
<td>Arsenic is ingested or inhaled; not usually absorbed through the skin. A common contaminant of drinking water (either naturally or as a by-product of mining, smelting, or the manufacturing of chemicals and glass). A component of the wood preservative chromated copper arsenate (CCA), widely used to treat outdoor-use wood (decks, playground equipment, fences, porches). Added to poultry feed as an antimicrobial, released into the environment through manure.</td>
<td>Test water (especially well water) for arsenic and filter/remediate if necessary. Reverse osmosis filtration systems can remove arsenic, but they are expensive. Wash children’s hands after playing on CCA-treated wood (“pressure-treated wood”). Seal CCA-treated wood structures every 1-2 years with sealant such as an oil-based stain or polyurethane, not paint. Avoid using CCA-treated wood for growing fruits/veggies or anything for human consumption. Never burn CCA-treated wood. Notes: In 2002, the Environmental Protection Agency (EPA) reduced the maximum contaminant level of arsenic in public water from 50 ppb to 10 ppb. Complete compliance is due by 2006. As of 2004 manufacturers no longer treat wood with CCA (residual stocks can be sold still depleted) but beware these structures still contain intact CCA.</td>
</tr>
</tbody>
</table>
Health Impacts of Arsenic

Acute Poisoning

Chronic Carcinogen
Arsenic Soil Exposure

Sierra Nevada soil 10-25 ppm, risk of dust inhalation not known
CCA treated wood playgrounds, decks, raised gardens prior to 2003
Cemeteries 1860-1910
Arsenic in Water

Drinking water standard reduced from 50 to 10 ppb in 2006
Serious Health Effects above 300 ppb
Found in both surface and well water
Shallow wells near cemeteries
Arsenic in Food

8 to 14 micrograms per day, depending on water contamination
Poultry, rice, cereals
Organic Brown Rice Syrup 23 to 128 ppb
Asbestos

Naturally occurring asbestos (NOA) includes fibrous minerals found in certain types of rock formations. NOA can take the form of long, thin, separable fibers. Natural weathering or human disturbance can break NOA down to microscopic fibers, easily suspended in air.

There is no health threat if NOA remains undisturbed and does not become airborne. When airborne NOA is inhaled, these thin fibers irritate tissues and resist the body's natural defenses.

Serpentine is the California State Rock—Here you can see the asbestos fibers in Serpentine.
Impact of Asbestos

Health Effects from Industrial Inhalation Exposure
Lung Cancer
Mesothelioma
Asbestosis
Pulmonary Fibrosis

Risks from Naturally Occurring Asbestos?
Crushed Serpentine used for Gravel Roads

Contractor in protective gear simulates baseball activity in El Dorado County, CA. (EPA, 2005)
Naturally Occurring Asbestos

Vein of Serpentine exposed during construction at El Dorado HS

EPA Study

Difficult to Assess Risk: Variety of Forms of NOA and variety of tests of levels

Cancer Registry Sierra Region
Ultramafic rocks (black) contains naturally occurring asbestos.


©2009 by Geological Society of America
Locations of Asbestos Mines
What’s the problem with dust?

Gold-bearing rock also contains other heavy metals including arsenic, lead and asbestos.

Millions of tons of rock were excavated and crushed every day as part of gold mining activities.
What’s the problem with dust?

Many of the forest roads and trails we use today go to or through abandoned mines

People riding OHVs, dirt bikes, and mountain bikes can be exposed to heavy metals in dust
Case 2 - Occupational/Take Home Exposures

✓ A day laborer goes to the ER for a work related injury.
✓ He is working on demolishing a firing range so a lead level is obtained and is 74 mcg/dl after 3 days on this job.
✓ Four other workers tested between 57 and 98 (all worked less than 2 ½ weeks).
✓ What should be done? None had previously worked with lead.

Hipkins KL, Materna BL, Payne SF, Kirsch LC., Clin Pediatri 2004
Case 2 - continued

Occupational/Take Home Exposures

✓ 9 children of three workers tested between 13 and 34 mcg/dl. (highest 18 month old)

✓ Wife of one with symptoms and Pb level of 36 mcg/dl.

✓ Workers may bring home hazards on clothing, shoes, and body.

✓ In 2001-2002 year, 22% of California childhood lead poisoning cases had potential contribution from occupational sources.
“Take-home” toxic exposures can be prevented by the following:
- Changing clothes at work;
- Showering before leaving work;
- Laundering work clothes separately;
- Removing shoes before entering the home, etc.

If hazardous substances are used by individuals working at home, care should be taken to keep the work and living areas separate – and hazardous materials must be stored and disposed of properly. Similarly, hobbies such as painting, model building, furniture refinishing, and auto repair often involve using toxic solvents. Pregnant and breastfeeding women, and children should avoid these exposures.
Summary

• The body of scientific evidence continues to build regarding the impact of environmental toxicants on children’s health

• A precautionary approach that emphasizes prevention is good patient and public health

• Guidance on preventing exposures to children and families can be incorporated by pediatric providers into well child visits using the *Pediatric Environmental Health Toolkit*

• Society needs to work on “upstream” prevention issues beyond the clinical setting
Acknowledgements

Primary Author:
Mark Miller MD MPH

Contributing Authors/Reviewers:
Michelle Gottlieb MEM, Guenter Hofstadler MD, Brian Linde MD, Siobhan McNally MD, Marybeth Palmigiano MPH, Kathy Shea MD, Gina Solomon MD MPH, Maria Valenti, David Wallinga MD MPA
Russell Towle, 1949-2008