



# The Pediatric Environmental Health Toolkit

## Training Program for Health Care Providers 2009

Pediatric Environmental Health Toolkit 2006

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

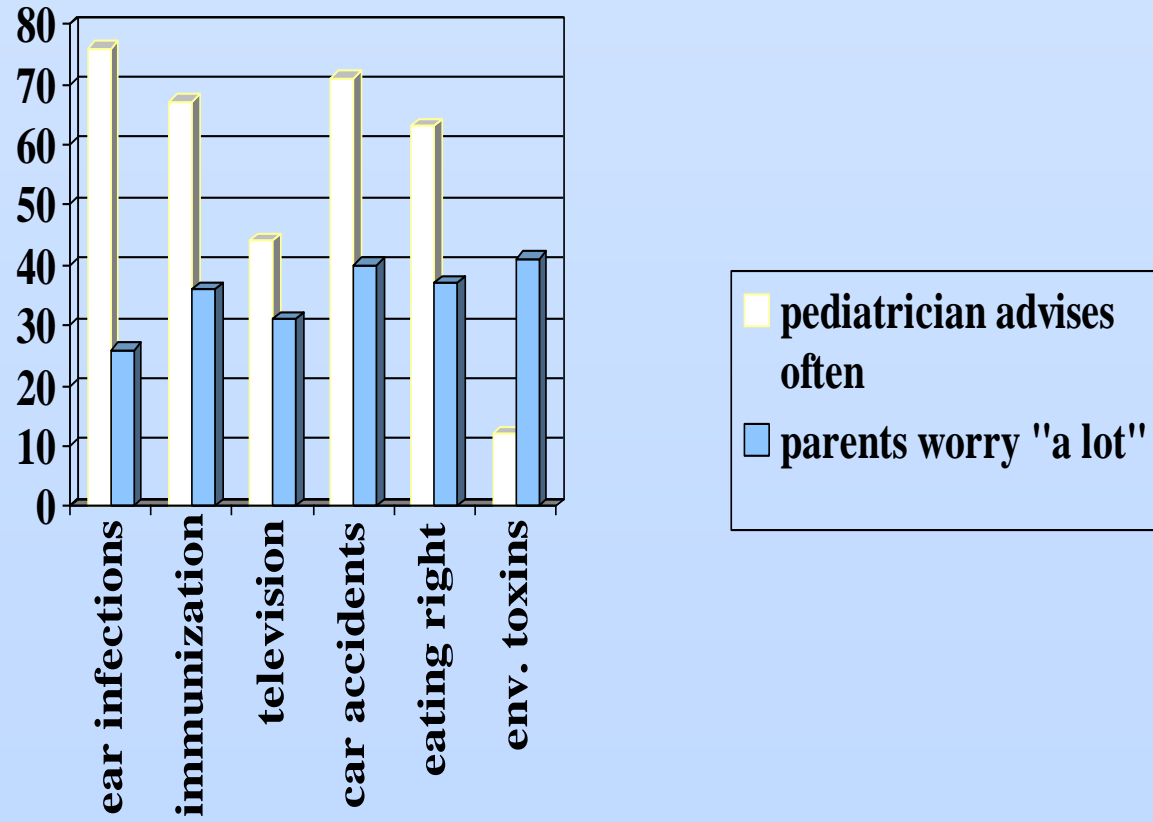


# What We Will Cover

- **Background on pediatricians' current practices related to environmental health**
- **The unique vulnerabilities of children**
- **The Pediatric Toolkit**
- **Case studies on environmental exposures**
- **How to use the Toolkit to address these issues**



# Parental Concern vs. Pediatrician Advice



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# **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**

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# 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**



# Chemicals Covered in Case Examples

**Pesticides**

**Heavy Metals: Arsenic, Mercury  
(Hg) & Lead (Pb)**

**Polychlorinated Biphenyls (PCBs)**



# 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

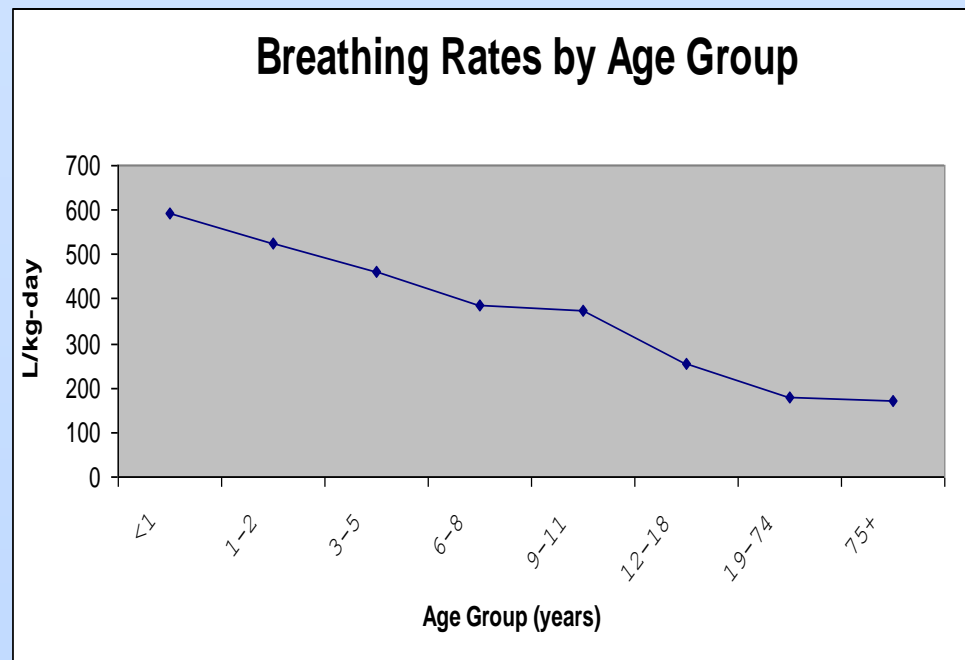
Increased metabolic rate

Higher minute ventilation

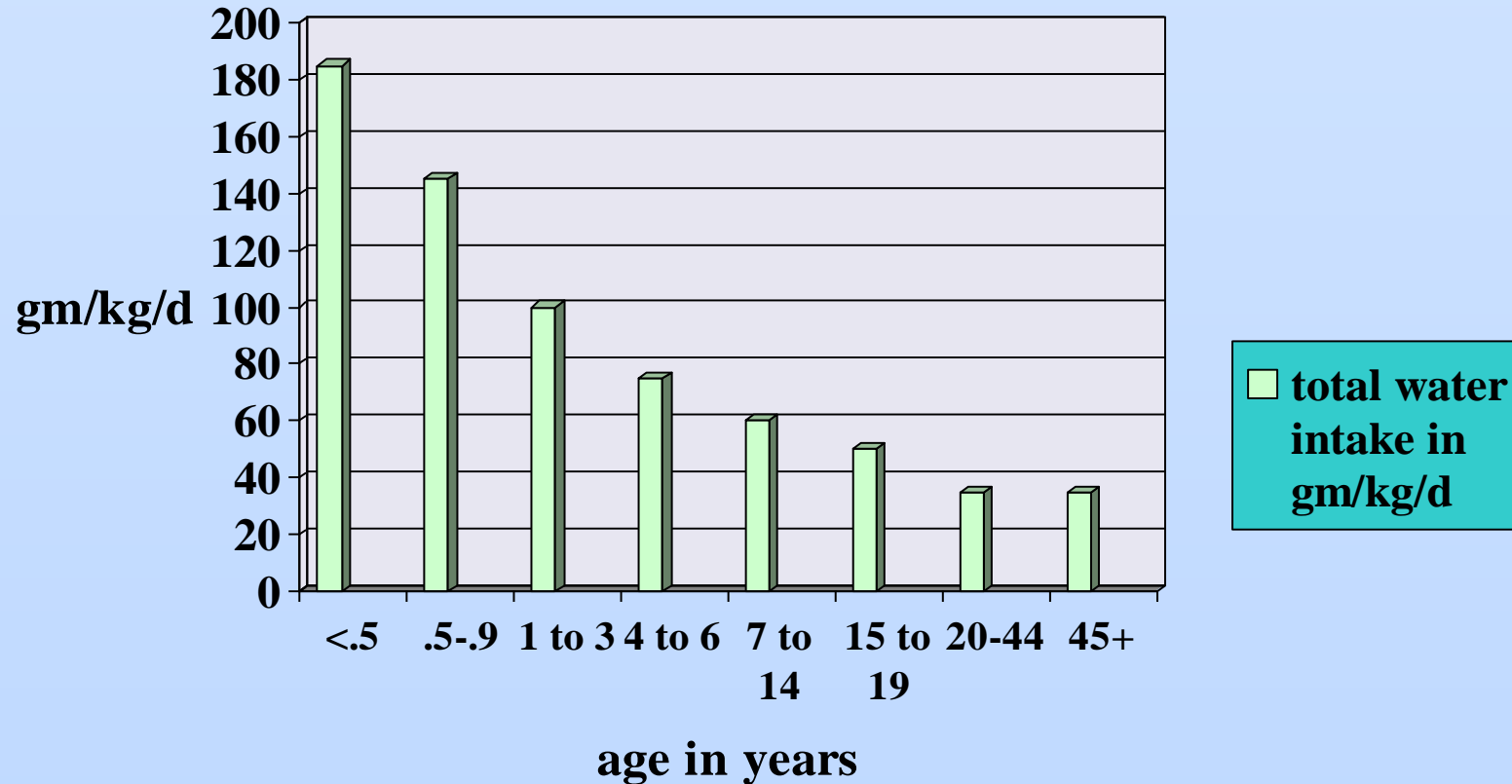
- Newborn 400 ml/min/kg
- Adult 150 ml/min/kg

Roughly double the surface area to body wt.

- Increased absorption from dermal route



# Mean Water Intake



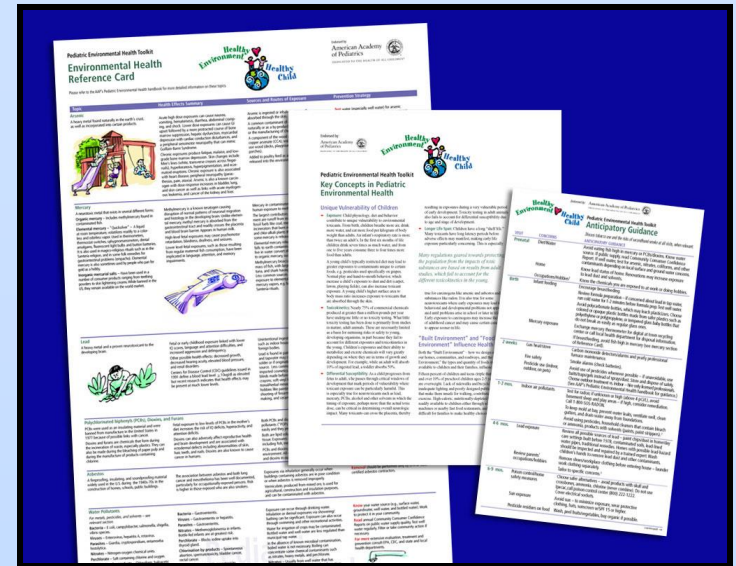
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# The Pediatric Environmental Health Toolkit

- 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 Patient Materials



birth-1 year

## 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.

Endorsed by:  
American Academy  
of Pediatrics  
  
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Find out more: [www.igc.org/psr](http://www.igc.org/psr)



**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](http://www.igc.org/psr)



# Case: Transient Hypertonia in an Infant

- ✓ 7lbs. 14 oz. term female, jaundice peak bili 12.6
- ✓ NI. PE at 12 weeks except BLE hypertonicity
- ✓ Pediatric & neurology consult at 16 weeks – BU/LE hypertonicity, ankle clonus-dx of cerebral palsy?
- ✓ PT begun
- ✓ No environmental hx taken



Case continued

# Transient Hypertonia in an Infant

- ✓ Diazinon 1% sprayed by unlicensed pesticide applicator prior to birth
- ✓ Levels still high 6 months later
- ✓ Serum cholinesterase WNL
- ✓ Urine metabolites high, similar to post-shift urine of applicators
- ✓ 6 weeks after removal from house muscle tone WNL




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# Anticipatory Guidance Card

Endorsed by: American Academy of Pediatrics  

**Pediatric Environmental Health Toolkit**  
**Anticipatory Guidance**

Discuss tobacco use and the risks of secondhand smoke at all visits, when relevant.

VISIT	CONCERNS	ANTICIPATORY GUIDANCE
Prenatal	Diet/Water	Avoid eating fish high in mercury or PCBs/dioxins. Know water source. If public supply, read Community Consumer Confidence Report. If well water, test for arsenic, nitrates, coliforms, and other contaminants depending on local surface and ground water concerns.
	Home	Know lead status of home. Renovations may increase exposure to lead dust and solvents.
	Occupations/Hobbies <sup>1</sup>	Know the chemicals you are exposed to at work or doing hobbies.
Birth	Infant feeding	Encourage breastfeeding. Review formula preparation – if concerned about lead in tap water, run cold water for 1-2 minutes before formula prep. Test well water. Avoid polycarbonate bottles, which may leach plasticizers. Choose colored or opaque plastic bottles made from safer plastics such as polyethylene or polypropylene, or tempered glass baby bottles that do not break as easily as regular glass ones.
	Mercury exposure	Exchange mercury thermometer for digital at town recycling center or call local health department for disposal information. If breastfeeding, avoid fish high in mercury (see mercury section of Reference Card).
2 weeks	Gas heat/stove	Carbon monoxide detectors/alarms and yearly professional furnace maintenance.
	Fire safety	Smoke alarms (check batteries).
	Pesticide use (indoor, outdoor, on pets)	Avoid use of pesticides whenever possible – if unavoidable, use baits/traps/gels instead of sprays/dust. Store and dispose of safely. Choose outdoor treatment vs. indoor – hire only licensed professionals. (See AAP's Pediatric Environmental Health handbook for guidance.)

Pesticide use (indoor, outdoor, on pets)

Avoid use of pesticides whenever possible – if unavoidable, use baits/traps/gels instead of sprays/dust. Store and dispose of safely. Choose outdoor treatment vs. indoor – hire only licensed professionals. (See AAP's Pediatric Environmental Health handbook for guidance.)



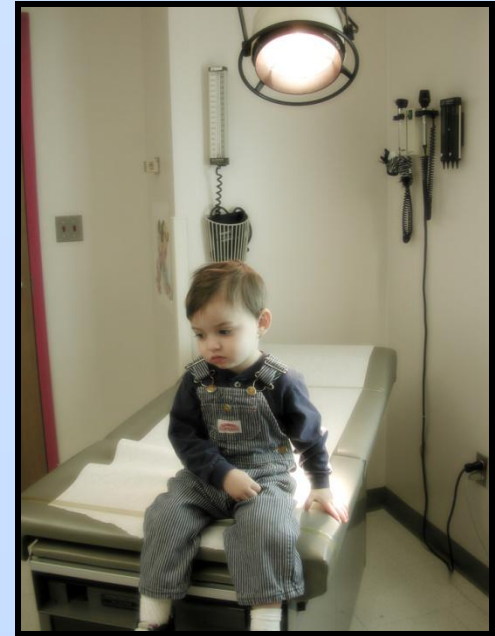
# Pesticides and Children

## Associations with:

1. Leukemia
  2. Non-Hodgkin's lymphoma
  3. Soft tissue sarcoma
  4. Brain tumors
- Same tumors found in adult studies

## Also Associated with:

1. Neurodegenerative d/o – Parkinson's Disease
2. Birth defects
3. Neurodevelopmental disorders



# Indoor Residues After Outdoor Pesticide Application

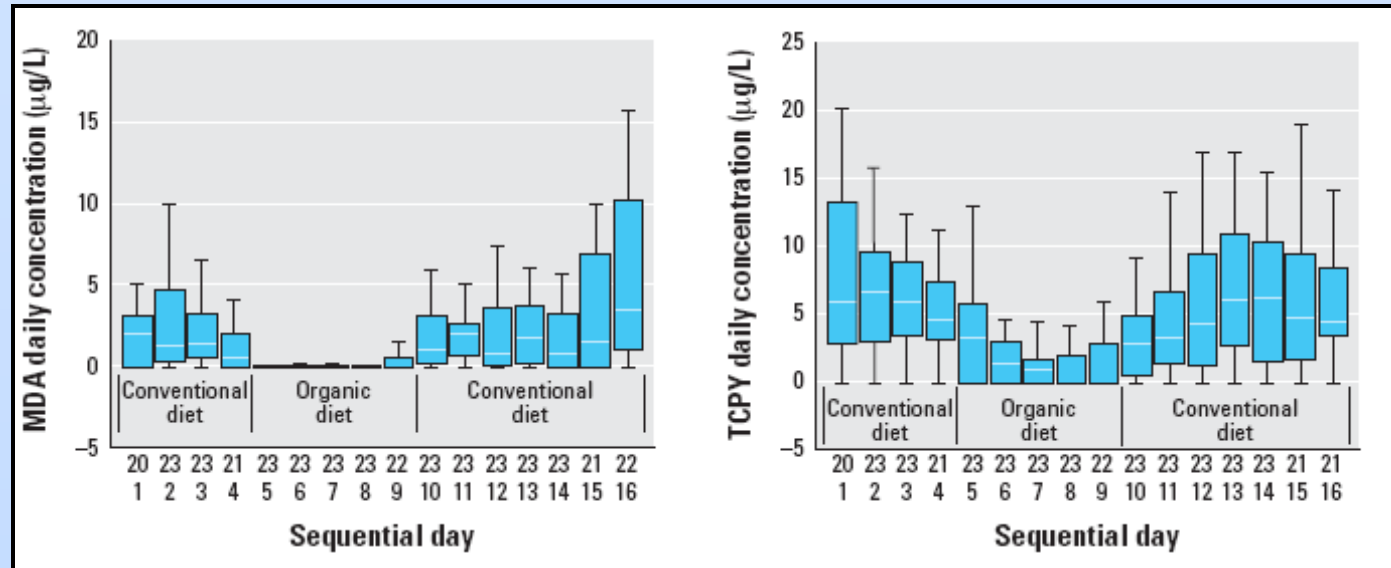
Pre-Application - 1.94 mcg/d

Post-Application – 8.87 mcg/d  
Two Weeks After Application

2,4-D pesticide tracked in by  
family dog and home owner  
(applicator)



# 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

**Shopper's Guide to Pesticides in Produce**



**Highest in Pesticides**

*These 12 popular fresh fruits and vegetables are consistently the most contaminated with pesticides—buy these organic.*



Apples	Peaches
Bell Peppers	Pears
Celery	Potatoes
Cherries	Red Raspberries
Grapes (imported)	Spinach
Nectarines	Strawberries

**Lowest in Pesticides**

*These 12 popular fresh fruits and vegetables consistently have the lowest levels of pesticides.*

Asparagus	Kiwi
Avocados	Mangos
Bananas	Onions
Broccoli	Papaya
Cauliflower	Pineapples
Corn (sweet)	Peas (sweet)

*This wallet guide brought to you by:*

 ENVIRONMENTAL WORKING GROUP 

# Case: Unexplained Symptoms in Family

**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 HAs, malaise**
- ✓ **Severe nosebleeds**
- ✓ **Both children have “grand mal” seizures and hyperesthesia**
- ✓ **Fish and houseplants have died**



# 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 continued

# Unexplained Symptoms

- Family used recycled “old” wood in their stove
  - Chromated Copper Arsenate (CCA) treated wood
  - Stove ashes w/ > 1,000 ppm arsenic in living area
- CCA – commonly used wood preservative (decks, playground equipment etc.) **No longer produced for residential use since 2003.**
- Arsenic – anti-metabolite, interferes with ATP cycle. Known human carcinogen



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# Advice for Patients & Providers

- Play Safe.** Choose play areas not made with CCA (chromated copper arsenate) pressure-treated wood which can contain toxic chemicals. If children play on wood decks or playground equipment made with treated wood, wash their hands well afterward.



1-4 years

*Rx for Prevention*

- Play Safe.** Choose play areas not made with CCA (chromated copper arsenate) pressure-treated wood which can contain toxic chemicals. If children play on wood decks or playground equipment made with treated wood, wash their hands well afterward.
- Have a Healthy Home.** Avoid using pesticides in your home, on your lawn or garden, or on pets. Keep pests out by sealing cracks around doors, windowsills, and baseboards. Prevent insect problems by quickly cleaning up food spills and crumbs, and eliminating standing water, a breeding ground for insects.

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American Academy of Pediatrics

Find out more: [www.jpcc.org/psr](http://www.jpcc.org/psr)

## Pediatric Environmental Health Toolkit Environmental Health Reference Card

### Topic

### Health Effects Summary

### Sources and Routes of Exposure

### Prevention Strategies

## Arsenic



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 sensorimotor neuropathy that can mimic Guillain-Barre Syndrome.

Chronic exposures produce fatigue, malaise, and low-grade bone marrow depression. Skin changes include Mees' lines (white, transverse creases across fingernails), hyperkeratosis, hyperpigmentation, and eczematoid eruptions. Chronic exposure is also associated with heart disease, peripheral neuropathy (parasthesias, pain, ataxia). Arsenic is also a known carcinogen with dose-response increases in bladder, lung, and skin cancer as well as links with acute myelogenous leukemia.

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.

**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 50ppb to 10ppb. Complete compliance is due by 2006. As of 2004 manufacturers no longer treat wood with CCA (existing stocks can be sold until depleted) but because these structures will remain intact for decades, children will be at

# Case: Concern About Fish Consumption

- ✓ **3½ yo male diagnosed w/developmental/behavioral d/o at age 3**
- ✓ **Otherwise healthy except eczema**
- ✓ **Birth Hx wnl**
- ✓ **Exclusively breastfed for 3 months, then formula**
- ✓ **Mother ate 1- 2 tuna steaks per week during 3<sup>rd</sup> trimester & while breastfeeding**
- ✓ **Relationship to development, testing, treatment?**



# Mercury (Hg): Health Effects of Prenatal Exposure

## Higher Dose

**Mental retardation, seizures, disturbances of vision, hearing, motor control**

## Lower Dose

**Impairments in attention, memory, and language  
Delayed conduction on BAER**



# Population Exposures are Significant – Government has Taken Action

- **CDC data show approximately 5.7-8% of US women of childbearing age exceed EPA defined safe exposure limit**
- **Government agencies provide guidance on mercury in fish**
- **States provide guidance on freshwater fish consumption guidelines**



# How Much Fish is Safe?

## IATP Fish Calculator

How much fish is 'safe' for you?

STEP  
1

Enter your body weight in pounds:

STEP  
2

Select the species of fish you eat:

STEP  
3

**Get your Results!**

[www.iatp.org](http://www.iatp.org)

Pediatric Environmental Health Toolkit

Environmental Health  
Reference Card

- Do Not feed children swordfish, shark, mackerel (King), and tilefish.
- “Chunk light” vs “solid white” albacore (limit amt based on weight)
- Serve a variety of fish and seafood - Haddock, pollock and shrimp are among the low fat, low mercury choices.

# Benefits of Maternal Fish Consumption Lessened by Hg Exposure

Fish is a good food source:

- Source of protein, iron, vitamin E, selenium, and long chain n-3 polyunsaturated fatty acids
- Higher fish consumption associated with *improved* infant cognition
- However...Higher Hg (even very low dose) associated with *reduced* cognition

**Suggests eating fish with less mercury**



# Case: 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 (Pb) level is obtained & is 74 mcg/dl after 3d on the job.
- ✓ 4 other workers test between 57 & 98 (all worked less than 2 ½ weeks).
- ✓ What should be done? None had worked w/ Pb before.



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**Case continued**

# **Occupational/Take Home Exposures**

- ✓ **9 children of 3 workers tested btw 13 & 34 mcg/dl. (highest 18 month old)**
- ✓ **Wife of one had sx-Pb level of 36 mcg/dl.**
- ✓ **Workers may bring home hazards on clothing, shoes, and body.**
- ✓ **2001-2002, 22% of CA childhood Pb poisoning cases potential contribution from occupational sources.**





Pediatric Environmental Health Toolkit  
**Key Concepts in Pediatric  
Environmental Health**

# KEY CONCEPTS

“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.



# Case: Exposure but no Symptoms

- ✓ Father concerned that for past 7 months oily residue found on driveway/car
- ✓ Children play in area
- ✓ Determined source: power transformer off property
- ✓ Is there potential danger?
  - Power company contacted and said nothing to worry about

## Know Your Resources:

**ATSDR, EPA regional, PEHSU, state offices, CROET**



# Polychlorinated Biphenyls

## Exposure In Utero

### Health Effects:

- Persistent Organic Pollutant
- Decrease in full scale and verbal IQ at 11 years old
- Decrease in word and reading comprehension
- Decrease in memory and attention



**Pediatric Environmental Health Toolkit  
 Anticipatory Guidance**

*Discuss tobacco use and the risks of secondhand smoke at all visits, when relevant.*

**ANTICIPATORY GUIDANCE**

VISIT	CONCERNS	ANTICIPATORY GUIDANCE
Prenatal	Diet/Water	Avoid eating fish high in mercury or PCBs/dioxins. Know water source. If public supply, read Community Consumer Confidence Report. If well water, test for arsenic, nitrates, coliforms, and other contaminants depending on local surface and ground water concerns.
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Birth	Infant feeding	Encourage breastfeeding. Review formula preparation – if concerned about lead in tap water, run cold water for 1-2 minutes before formula prep. Test well water. Avoid polycarbonate bottles, which may leach plasticizers. Choose colored or opaque plastic bottles made from safer plastics such as polyethylene or polypropylene, or tempered glass baby bottles that do not break as easily as regular glass ones.
	Mercury exposure	Exchange mercury thermometer for digital at town recycling center or call local health department for disposal information. If breastfeeding, avoid fish high in mercury (see mercury section of Reference Card).
	Gas heat/stove	Carbon monoxide detectors/alarms and yearly professional furnace maintenance. Smoke alarms (check batteries).
2 weeks	Fire safety	Avoid use of pesticides whenever possible – if unavoidable, use baits/traps/gels instead of sprays/dust. Store and dispose of safely. Choose outdoor treatment vs. indoor – hire only licensed professionals. (See AAP's Pediatric Environmental Health handbook for guidance.)
	Pesticide use (indoor, outdoor, on pets)	
1-2 mos.	Indoor air pollutants	Test for radon; if unknown or high (above 4 pCi/L), avoid basement sleep and play areas – if high, consider remediation. Call 1-800-505-RADON. To keep mold at bay, prevent water leaks, ventilate well, clean gutters, and drain water away from foundations. Avoid using pesticides, household cleaners that contain bleach or ammonia, products with solvents (paints, paint strippers). <sup>1</sup>
	Lead exposure	Review all possible sources of lead – paint chips/dust in home/day care settings built before 1978, contaminated soils, lead-lined water pipes, traditional remedies. Homes with possible lead-hazard should be inspected and repaired by a trained expert. Wash children's hands to remove lead dust and other contaminants.
4-6 mos.	Review parents' occupations/hobbies	Remove shoes/workplace clothing before entering house – launder work clothing separately. Tailor to specific concerns. <sup>1</sup>
	Poison control/home safety measures	Choose safer alternatives – avoid products with skull and crossbones, ammonia, chlorine (never combine). Do not use lpeac, call poison control center (800) 222-1222. Cover electrical sockets.
6-9 mos.	Sun exposure	Avoid sun – to minimize exposure, wear protective clothing, hats, sunscreen w/SPF 15 or higher.
	Pesticide residues on food	Wash, peel fruits/vegetables, buy organic if possible.

continued →

# Breastfeeding is Best for Baby



**Birth Infant feeding**

**Encourage breastfeeding.**

Review formula preparation – if concerned about lead in tap water, run cold water for 1-2 minutes before formula prep. Test well water. Avoid polycarbonate bottles, which may leach plasticizers. Choose colored or opaque plastic bottles made from safer plastics such as polyethylene or polypropylene, or tempered glass baby bottles that do not break as easily as regular glass ones.

**Mercury exposure**

Exchange mercury thermometer for digital at town recycling center or call local health department for disposal information. If breastfeeding, avoid fish high in mercury (see mercury section of Reference Card).

# 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 & public health
- Guidance on preventing exposures to children and families can be incorporated into well child visits using the *Pediatric Environmental Health Toolkit*
- Society needs to work on “upstream” prevention issues beyond the clinical setting



# Acknowledgements

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# For More Information



## Oregon Physicians for Social Responsibility

**503-274-2720**

**[www.oregonpsr.org](http://www.oregonpsr.org)**

**PDFs of materials available at  
<http://psr.igc.org/ped-toolkit-project.htm>**

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