Pediatric Environmental Health

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What is Environmental Health?

Disease Burden

Genetic

Economic

Psychosocial

Environment

Diet
Air
Water
Built/Physical
Definitions

- PEH – how the environment influences human health and disease

- “Environmental health includes both the direct pathologic effects of chemicals, radiation and some biological agents and the effects on health and wellbeing of the broad physical, psychological, social, and aesthetic environment which includes housing, urban development, land use and transport”

  – World Health Organization
Children’s Vulnerability

- Children are not little adults
- More susceptible to environmental exposures:
  - increased hand to mouth play
  - on the ground play
  - increased respiratory rate
  - decreased ability to metabolize/excrete as infants
  - increased surface area/body volume
  - unique developmental vulnerabilities
Expanding Evidence Base

- **Asthma**
  - ETS
  - Outdoor Air pollutants (particulate matter, ozone, etc)
  - Mold
  - Pesticides (Pyrethrins)

- **Neurodevelopmental disorders**
  - Lead, PCBs, Mercury, Pesticides, CO, Synthetic chemicals

- **Obesity**
  - Built Environment, Endocrine Disruptors

- **Reproductive/Endocrine disorders**
  - Perchlorate, DDT, Phthalates, Bisphenol A

- **Cancer**
  - Pesticides, Radon, EMFs, Solvents, Synthetic Chemicals
Key Components to PEH

- Good environmental history
- Appropriate testing/diagnosis
- Treatment/Education
Pediatric Environmental History (0-18 Years of Age)

The Screening Environmental History

For all of the questions below, most are often asked about the child’s primary residence. Although some questions may specify certain locations, one should always consider all places where the child spends time, such as daycare centers, schools, and relative’s houses.

**Where does your child live and spend most of his/her time?**

**What are the age, condition, and location of your home?**

**Does anyone in the family smoke?**
- Yes
- No
- Not sure

**Do you have a carbon monoxide detector?**
- Yes
- No
- Not sure

**Do you have any indoor furry pets?**
- Yes
- No
- Not sure

**What type of heating/air system does your home have?**
- Radiator
- Forced Air
- Gas stove
- Wood stove
- Other:

**What is the source of your drinking water?**
- Well water
- City water
- Bottled water

**Is your child protected from excessive sun exposure?**
- Yes
- No
- Not sure

**Is your child exposed to any toxic chemicals of which you are aware?**
- Yes
- No
- Not sure

**What are the occupations of all adults in the household?**

**Have you tested your home for radon?**
- Yes
- No
- Not sure

**Does your child watch TV, or use a computer or video game system more than two hours a day?**
- Yes
- No
- Not sure

**How many times a week does your child have unstructured, free play outside for at least 30 minutes?**

**Do you have any other questions or concerns about your child's home environment or symptoms that may be a result of his or her environment?**

**Follow up/Notes**

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The Screening Environmental History is taken in part from the following sources:

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This screening environmental history is designed to capture most of the common environmental exposures that children may be exposed to. It is not a substitute for a comprehensive environmental assessment or medical evaluation. If a positive response is given to one or more of these screening questions, the primary care provider can consider asking further questions as appropriate. This completes the Screening Environmental History.
MR is a four year old female who comes into the ER. Her parents state that occasionally they notice that her entire back turns blue. During these episodes, she is alert with normal activity, and the blue eventually fades away.
Family lives in a rural area in a new home supplied with well water
Dad owns his own organic farm
Mom stays at home with the kids (ages 4 and 8 years)
4yr is otherwise healthy with normal development
Physical Exam – normal
Nitrate Toxicity

■ 14 million homes in the US supplied with well water, estimates of >10,000 wells with nitrate levels above the EPA limit

■ Causes methemoglobinemia. Nitrates oxidize hemoglobin to methemoglobin (Fe $^{+2}$ $\rightarrow$ Fe $^{+3}$)

■ In infants, NADH/NADPH methemoglobin reductase has $\frac{1}{2}$ activity as it does in adults
### Table 1. Signs and symptoms of methemoglobinemia.

<table>
<thead>
<tr>
<th>MetHb concentration (%)</th>
<th>Clinical findings</th>
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<tbody>
<tr>
<td>10–20</td>
<td>Central cyanosis of limbs/trunk</td>
</tr>
<tr>
<td>20–45</td>
<td>Central nervous system depression (headache, dizziness, fatigue, lethargy), dyspnea</td>
</tr>
<tr>
<td>45–55</td>
<td>Coma, arrhythmias, shock, convulsions</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>High risk of mortality</td>
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</tbody>
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Adapted from Kross et al. (1992).
**Work-up/Treatment**

- CBC w/ smear, examination of blood color
- Methemoglobin testing

**Treatment:**
- ABC with 100% oxygen
- If Methemoglobin >20%, IV administration of methylene blue (reduces methemoglobin → hemoglobin)
“Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms and cause illness. Children may also drink well water at child care or when traveling. Illness resulting from children's ingestion of contaminated water can be severe. This policy statement provides recommendations for inspection, testing, and remediation for wells providing drinking water for children.”
AAP Publication

Pediatric Environmental Health, November 2003
Case Studies in Environmental Medicine

Course: SS3046
Revision Date: March 2000
Original Date: October 1992
Expiration Date: June 30, 2003

Taking an Exposure History, March 2000

Environmental Alert
- Because many environmental diseases either manifest as common medical problems or have nonspecific symptoms, an exposure history is vital for correct diagnosis. By taking a thorough exposure history, the primary care clinician can play an important role in detecting, treating, and preventing disease due to toxic exposure.

http://www.atsdr.cdc.gov/HEC/CSEM/exphistory/goals_objectives.html
Environmental Health, October 2001
Jerome Paulson, MD, Editor