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LESSON:

Mothers' Milk—Unleaded, Please

Summary: Students read a news article about a small study of nursing mothers in Taiwan whose breast milk contained lead, apparently linked to the consumption of contaminated herbal remedies. Students look at national screening recommendations for lead and discuss whether the recommendations should be changed in light of these new findings.

Lesson Type: Short Lesson—this lesson will take 20 to 30 minutes to implement.

***EHP* Article:** "High-Test Mothers' Milk"
EHP Student Edition, September 2006, p. A344
http://www.ehponline.org/docs/2006/114-6/forum.html

Objectives: By the end of this lesson, students should be able to

1. describe why lead exposure is dangerous to children and infants;
2. identify at least two common sources of lead in the environment;
3. distinguish between primary and secondary prevention strategies;
4. describe risk factors that indicate a child should be screened for lead under the 1997 CDC guidelines for lead; and
5. make some suggestions about how screening might be changed in light of recent findings.

Class Time: 30 minutes

Grade Level: 9–12

Subjects Addressed: Health, Nutrition, Statistics, Environmental Health, Social Studies

Prepping the Lesson (15 minutes)

INSTRUCTIONS:

1. Download the article "High-Test Mothers' Milk" at http://www.ehponline.org/docs/2006/114-6/forum.html.
2. Review the Background Information, Instructions, and Student Instructions.
3. Make copies of the Student Instructions.
4. Decide if the students will access the Internet to complete Step 2. If students do not have Internet access, you can print information from websites cited in the Resources section and hand it out to the students.

MATERIALS (per student):

- 1 copy of the article "High-Test Mothers' Milk," *EHP Student Edition*, September 2006
- 1 copy of the Student Instructions
- computer with Internet access or hand-outs on sources of lead in the environment

VOCABULARY:

- colostrum
- demographic
- *in utero*
- lactation
- lead
- menstrual
- neonatal
- neurotoxicant
- occupational

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- perinatal
- primary prevention strategy
- postpartum
- secondary prevention strategy

BACKGROUND INFORMATION:

Lead in the environment from leaded paint and gasoline is a well-established health hazard for children in the United States, especially in areas in which there is a high rate of poverty and old housing. It has been documented that plants can take up lead when cultivated in soils with high lead concentrations (Raloff 2003). Numerous studies have also found lead in various traditional or folk remedies from around the world. Many states' guidelines for lead screening specifically mention the consumption of folk remedies as a risk factor for lead exposure (CDC 1997). There is a current controversy about the likely reduction of the nationally accepted "threshold of concern" for blood lead levels below the current standard of 10 micrograms per deciliter as increasing evidence emerges that levels below this threshold have measurable impacts on children's development and intelligence (Schnaas 2006). The study (Chien 2006) cited in the *EHP Student Edition* article is mainly of significance in that it demonstrates breast milk as a route of exposure for infants. Although the study does not conclusively prove harm to the infants studied, it does suggest that this route of exposure may be significant for populations in China, where traditional remedies are widely used and environmental regulations on lead are not well established.

References:

CDC. 1997. *Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials*. Atlanta, GA: Centers for Disease Control and Prevention.

Chien LC, Yeh CY, Lee HC, Jasmine Chao H, Shieh MJ, Han BC. 2006. Effect of the mother's consumption of traditional Chinese herbs on estimated infant daily intake of lead from breast milk. *Science of the Total Environment* 354(2–3):120–126.

Raloff J. 2003. Leaden gardens. *Science News Online* 164(23); http://www.sciencenews.org/articles/20031206/food.asp

Schnaas L, Rothenberg SJ, Flores M-F, Martinez S, Hernandez C, Osorio E, et al. Reduced intellectual development in children with prenatal lead exposure. *Environmental Health Perspectives* 114:791–797; http://www.ehponline.org/members/2005/8552/8552.html

RESOURCES:

Environmental Health Perspectives, Environews by Topic page, http://ehp.niehs.nih.gov. Choose Lead, Metal Toxicity

Agency for Toxic Substances and Disease Registry, ToxFAQs for Lead (a brief fact sheet on the toxological properties of lead including common sources), http://www.atsdr.cdc.gov/tfacts13.html

Centers for Disease Control and Prevention, Lead (an excellent resource with links to guidelines, recent research, and local programs), http://www.cdc.gov/lead

Environmental Protection Agency, Lead in Paint, Dust, and Soil (a general website on lead safety that is also available in Spanish), http://www.epa.gov/lead/pubs/leadinfo.html

Implementing the Lesson

INSTRUCTIONS:

1. Have students read the article "High-Test Mothers' Milk" in class. Students may underline unfamiliar words for later definition or clarification in class, if desired.
2. Lead a brief discussion about the study, highlighting the study design and the methods described. In particular, be sure to address
   a. the low response rate of 16/72,
   b. the low total number of participants ("n") of 16, and
   c. the classic control vs. experiment design in which the experiment group exposed themselves to the substance of interest (the herbal remedies).
3. Have students complete the Student Instructions. Step 2 instructs the students to conduct some research on the Internet to identify potential sources of lead in the environment. If you do not have access to the Internet, print out some lead fact sheets that contain the necessary information and hand them out to the students. Useful websites are provided in the Resources section.

NOTES & HELPFUL HINTS:

- It may be useful to read the article aloud as a class, with students taking paragraphs at a time to discuss each section. This is an especially good technique with students who are new to the subject matter or have a lower reading level.
- This can be assigned as homework or done in class.

Aligning with Standards

SKILLS USED OR DEVELOPED:
- Communication (note taking—oral, written)
- Comprehension (listening, reading)
- Critical thinking and response

SPECIFIC CONTENT ADDRESSED:
- Environmental health
- Nutrition
- Public health recommendations
- Research study design

NATIONAL SCIENCE EDUCATION STANDARDS MET:

Science Content Standards

Unifying Concepts and Processes Standard
- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement

Science as Inquiry Standard
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Science in Personal and Social Perspectives Standard
- Personal and community health
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

History and Nature of Science Standard
- Science as a human endeavor
- Nature of scientific knowledge

Assessing the Lesson

Step 1: Students should read the entire article, underlining unfamiliar words for later discussion or definition, if necessary. Students must be able to identify basic facts about the article and the research it cites—for instance, where the study took place, how many women participated, and why lead exposure is harmful to children. As for the discussion questions, students should note the low response rate and few participants as possible weaknesses of the study. Obviously a larger "n" would have been preferable, but students may note the unwillingness of women with newborns to give monthly samples during what is usually a very busy and stressful time.

Step 2: Students should use the Internet or printed materials to identify common sources of lead in soil in the United States. The most common of these are the deposition of lead solids from air pollution from leaded gasoline (pre-1991), paint that has flaked off into the soil from houses painted before 1979, and large bridges or tunnels that still legally use leaded paint (for durability); much more rarely, industrial pollution comes from smelting or other processes. Students may hypothesize that since environmental controls are just now emerging in China, lead contamination of the soil likely would result from similar sources.

Step 3: Additional primary prevention strategies such as regulations or recommendations to protect infants from Chinese medicinal herbs as a source of lead include limiting breastfeeding in known cases of very high exposure to the mother, closely monitoring the purity and toxicity of imported Chinese herbs, and limiting intake of Chinese herbs during pregnancy and lactation. Students should mention the costs associated with increased monitoring and testing of herbal supplements, which are currently unregulated. Students should also note the value of breastfeeding in all but the most extreme cases of maternal lead exposure.

Step 4: After students read the secondary prevention strategies involving the screening guidelines for lead, they could suggest any of the following changes or additions as a result of the findings in the study:

- screen pregnant women in target areas
- screen newborns in target areas
- screen any woman known to be taking Chinese traditional remedies, especially if the woman intends to become pregnant or is pregnant

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Give us your feedback! Send comments about this lesson to ehpscienceed@niehs.nih.gov.

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STUDENT INSTRUCTIONS: Mothers' Milk—Unleaded, Please

Step 1: Read the article "High-Test Mothers' Milk," *EHP Student Edition*, September 2006, p. A344.

Step 2: In the article, the likely source of the lead in the Chinese remedies was "contaminated soil." Use the Internet or the materials provided by your teacher to identify two common sources of lead in soil in the United States. List the sources below. Do you think it is likely that China has similar sources of lead in its environment? Why or why not?

Step 3: In the field of public health, there are two approaches to preventing health problems—"primary" prevention, in which a hazard is kept from exposing/harming people at all, and "secondary" prevention, which focuses on identifying exposed individuals so they can be treated or removed from danger. What primary prevention strategies might be implemented to protect children against exposure to lead from contaminated herbal remedies?

Step 4: In 1997, the Centers for Disease Control and Prevention issued new guidelines to doctors about who should be routinely screened for high blood lead levels (secondary prevention). These include:

- All one- and two-year-olds living in areas in which more than 27% of housing was built before 1950
- All one- and two-year-olds whose families receive Medicaid benefits because of low income
- Children whose parents indicate they are living in a house under renovation
- Children whose sibling(s) have been found to have high blood lead

Individual states have added other categories to their lead screening protocols. What other secondary prevention strategies might you recommend, given the results of the Taiwan study cited in the *EHP Student Edition* article?

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