**Activity 1.1**

The class period is designed to have three components:

* A discussion and associated PowerPoint with included video (10 minutes),
* An activity to answer questions based off of a table either individually or in groups (10 minutes),
* And a class Jeopardy game (30 minutes).

We chose lead as the topic of this module because it is toxic to everyone, leaves permanent damage, and the symptoms are difficult to recognize. Specifically, lead causes damage to the brain and nervous system with even very small amounts dangerous as lead builds up in your body over time. However, children under 6 are especially at risk because they are more likely to come into contact with lead via household dust and paint, and also because they absorb it more easily than adults. In pregnant women, lead is linked to miscarriages, premature birth, low birth weight, brain damage, and reduced growth in young children. Once lead enters your body, it is distributed similar to other minerals and typically ends up in the bone, interfering with calcium absorption, thus hindering transmission of signals through neurocognitive pathways. In other words, every single message the brain wants to send out to move, act, or think, requires the use of these pathways. When lead replaces calcium in the neurological system these messages can’t get through.

Starting with a short talk and PowerPoint allows for students to understand in further detail some key elements about lead that they learned in their pre-class reading. Making this portion as interactive as possible through questions and discussion will benefit the student's knowledge and set a precursor for communication for the duration of the class. The short video embedded in the PowerPoint (slide 2) gives a brief overview of lead uses and its history. **Activity 1.1**, also embedded in the PowerPoint (slide 3) is intended to be conducted as a pre-assessment and brainstorming exercise to help students identify the information they will need to be able to predict who is at risk for lead poisoning. The presentation is to be completed after Activity 1.

Once this portion of the class is complete, Jeopardy should be played. This allows for students to test what they know in an encouraging and interactive setting. Be sure students engage in this activity. For large classes, students may work in small groups. If you are interested in holding a class primarily focused on communicating with one another, it would be best to cut down time for the PowerPoint and activity, while mainly focusing on Jeopardy.

After the Jeopardy game has finished, this question should be posed to the class. It allows students to reflect on what they have just learned and apply it to their everyday lives.

* Have you ever encountered health issues related to lead in either your education or the media prior to this course? Based on your prior knowledge and our class today, do you think lead safety be included more or less in these areas?

**TEACHING TIPS:**

* Student activity 1.1 could potentially be assigned as homework after this class, by asking the students to re-examine and add to their initial answers after having heard the remainder of the Unit 1 Presentation and using the additional web-based resources at the bottom of the worksheet.
* Note that the mean blood lead levels provided in the table are estimates based upon available data and plausible exposures; a brief explanation of their derivation is provided in the discussion notes.

*Possible responses to Activity 1.1 are included below.*

**Activity 1.1: Historical comparisons of elevated blood lead levels (eBLLs)**

*Referring to the table, students are asked to answer the following questions (possible responses are in italics):*

This table shows the approximate mean blood lead level (BLL) of 2-year-old children in several different places at different times in history.

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Location** | **Mean BLL** | **Source** |
| 3500 BCE | All 2 year old children in area now called USA | .016 µg/dL | Adapted from  Riva, M.A., A. Lafranconi, M.I. D’orso, and G. Cesana. 2011. Lead Poisoning: Historical Aspects of a Paradigmatic “Occupational and Environmental Disease.” Safety and Health at Work; 3(1): 11-16. http://dx.doi.org/10.5491/SHAW.2012.3.1.11 |
| 1970 | Mean for 2 year old children in USA | 15 µg/dL | <http://www.cdc.gov/>  Blood Lead Levels – United States, 1988-1991. August 05, 1994 / 43(30); 545-548. http://www.cdc.gov/mmwr/preview/mmwrhtml/00032080.htm |
| 1970 | Boston, MA | 20 µg/dL | Extrapolated from national average CDC data |
| 2010 | Boston, MA | 3 µg/dL | Extrapolated from national average CDC data |
| 2010 | Mean for 2 year old children in USA | 1.5 µg/dL | <http://www.cdc.gov/>  Blood Lead Levels in Children Aged 1-5 Years – United States, 1999-2010. April 05, 2013 / 62(13); 245-248. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6213a3.htm |

1. Characterize the difference in mean BLL between children living in the geographic area now referred to as the US in 6000BP, 1970 and 2010. What might explain observed differences?

*There is nearly a three-order magnitude (factor of 1000) difference between pre-industrial humans and children living in the US in 1970. Based on samples from pre-industrial human bones, Smith and Flegal (1992) estimated the pre-industrial blood lead level in humans to be .016 ug/dL. Since 1970, with the removal of lead from paint and gasoline in the U.S., exposures have dropped dramatically (by an order of magnitude), but are still 100 times those of pre-industrial humans.*

1. Characterize the difference in mean BLL between children living in Boston, MA in 1970 and 2010. What do you think might explain this difference?

*This primarily reflects the removal of lead from gasoline and replacement of older housing. Students who do extra research on local policies may also discover Boston’s strong housing-based lead law, childhood lead poisoning prevention program, and public housing. It might be interesting to note that in 1970 the BLL in Boston was significantly higher than the U.S. mean since, in addition to exposure to lead in gasoline, an old city like Boston had many children living in housing built before 1950 (when there were high levels of lead in paint) and a concentration of “lead industries” that likely emitted lead into the air.*

1. Given the mean BLL in 2010 in Boston, MA, predict the mean BLL for Phoenix, AZ, and explain why you made this prediction.

*Phoenix, AZ, is a much newer city with a smaller proportion of pre-1978 housing than Boston. Unless there is localized exposure to mines or lead industries in Phoenix, it is likely that the mean BLL will be below the national mean of 1.5 ug/dL. Boston has a large proportion of pre-1978 housing and history of lead industries, so the mean BLL is likely to be above the national mean of 1.5 ug/dL*(MMWR, 2013).

1. If you are interested in identifying populations at high risk of lead poisoning, brainstorm what additional information you might want to gather about these observations and patterns.

**RESOURCES FOR ADDITIONAL EXPLORATION OF THIS ACTIVITY**:

USGS Mineral Resources Data System

<http://mrdata.usgs.gov/mrds/> - click on “by commodity”; in the checklist on the left, click on “county names” and magnify until you can see the county name you want, then select “lead.”

Centers for Disease control – click on “Data, Statistics, and Surveillance” then select State Summaries to explore available data on childhood lead-poisoning rates

<http://www.cdc.gov/nceh/lead/data/index.htm>

Why is lead an issue? Not because it’s a heavy metal, but because of its connections to other areas. Show the link to calcium and what lead does to the bones. The impact on kids that don’t drink calcium, contained in foods like milk, is that they are at a greater risk for lead to stay in their bodies.