

PLUMBING THE DEPTHS OF ELEVATED CHILDHOOD LEAD LEVELS IN OREGON

We know lead as a useful but potentially deadly heavy metal. In the 20th century, lead was used in paint and added to gasoline before being banned, but lead's history goes back much further. In ancient Rome, lead (Latin: *plumbum*) was used in pipes supplying water to cities, in cosmetics and dishware, and as a sweetener for food and a preservative for wine. The ubiquity of this toxic metal meant chronic exposure for many Romans, and is hypothesized to have played a role in the incompetence (and impotence) of the ruling elite, from Claudius to Caesar, and ultimately the decline and fall of the Roman Empire.

Exposure to lead can affect many organ systems causing adverse health effects. Lead is particularly harmful to the developing brains and central nervous systems of young children. Symptoms of toxicity include: slowed development; and learning, behavioral, hearing, and speech problems.¹

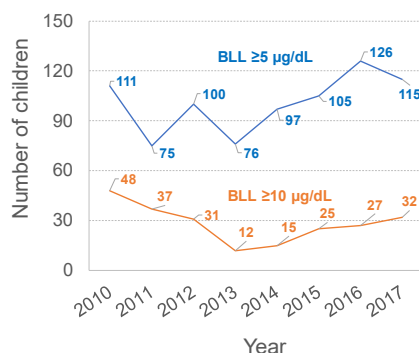
Thankfully, childhood blood lead levels (BLLs) have steadily declined across the U.S. over the past three decades, a testament to the success of federal, state, and local lead prevention programs. These efforts have focused on reducing environmental sources (e.g., lead in gasoline), as well as improving screening, outreach, and education on lead poisoning prevention.

Despite these environmental and public health gains, lead exposure persists. The CDC estimated that approximately 500,000 children in the U.S. ages 1–5 years have a blood lead level $\geq 5 \mu\text{g}/\text{dL}$.¹ In this *CD Summary* we review the most recent data on elevated blood lead levels and sources of exposure in Oregon children, and how clinicians can help.

OREGON DATA

While the CDC has not identified any safe BLL, in 2012 it established a BLL of $5 \mu\text{g}/\text{dL}$ as the level for public health action (previously the level of concern was $10 \mu\text{g}/\text{dL}$). This reference value is based on 2007–2010 data from the National Health and Nutrition Examination Survey (NHANES), although studies show that BLLs below this may cause harm to children.² In Oregon, an average of 115 children have been confirmed with BLL at or greater than $5 \mu\text{g}/\text{dL}$ annually since 2015, when Oregon formally adopted the new reference level (Figure 1).

Figure 1. Children <6 years with elevated blood lead levels, Oregon 2010–2017



Determining the accurate prevalence of elevated BLLs among Oregon children depends on the number of children who get tested. In recent years, the percentage of Oregon children less than 6 years of age tested for blood lead has been increasing, reaching approximately 7% in 2017 and 2018. However, this is still below the national average of about 10%.³

One consequence of low testing rates is that many children with elevated BLLs are not identified. A recent study using NHANES data estimated that only 8% of lead-poisoned children in Oregon were diagnosed from 1999–2010.⁴

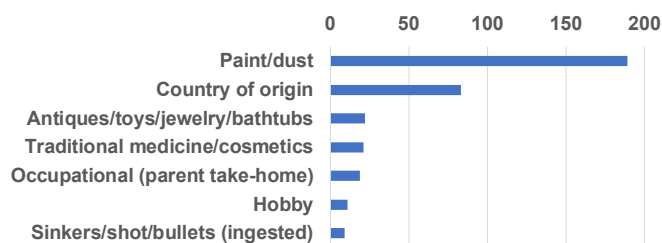
SOURCES OF EXPOSURE

Data from Oregon show that exposure to deteriorating lead-based paint and dust in homes built prior to 1978 continues to be the probable source in most confirmed lead poisoning cases (Figure 2). This is true for the U.S. as well, but fortunately, lead-based paint hazards are generally lower in Oregon compared to the Northeast and Midwest, due in part to our newer housing stock.⁵

The most common exposure pathways include ingestion through hand-to-mouth contact with lead-containing dust and debris, and inhalation of fine dust particles containing lead. Lead in dust may be absorbed directly through the lungs or carried back up to the throat via mucociliary clearance, ultimately being swallowed and absorbed through the gastrointestinal tract.

Other sources of lead poisoning are associated with regional or cultural factors. These include lead-containing bullets, lead shot, fishing weights, anchors, *chapulines* (crickets from Mexico), *barro* or *chilmolera* pottery used for preparing or serving food, and cosmetics or religious powders from

Figure 2. Probable sources for childhood lead exposure (BLL $\geq 5 \mu\text{g}/\text{dL}$), Oregon 2013–2017



South Asia, Africa, and the Middle East, known as *kohl*, *kajal*, *surma*, *tikka*, or *sindoor*. Some cases involved exposure to metal jewelry containing lead, or toys and other objects painted with lead-based paint. Finally, uncommon (but not unheard of) sources include: consumption of contaminated soil, exposure to dust tracked into the home from occupational sources, and exposure to dust and fumes from a hobby such as casting fishing weights or pouring lead bullets.

DRINKING WATER AND LEAD

In 2014, the discovery of lead in the public water system in Flint, Michigan⁶ renewed national interest in lead poisoning as an environmental hazard for young children. Closer to home, water testing revealed elevated lead concentrations in Portland Public Schools in 2016, prompting ongoing public and media attention. Although cities and water districts in Oregon do not use lead pipes to supply water to homes and schools, lead can be found in water at the tap due to water chemistry reacting with pipe solder or plumbing components that contain lead. The state Drinking Water Program regulates corrective actions to minimize this risk. The focus on lead in water has led to new rulemaking for testing water used for drinking or food preparation in Oregon public schools.

The continued attention on lead in drinking water belies the fact that drinking water is not a major source of lead poisoning in Oregon. In fact, of the thousands of Portland children who received blood tests for lead, the few with high levels were found to have probable sources other than drinking water.

THE ROLE OF PUBLIC HEALTH

Laboratories are required to report all blood lead test results to the local health authority or Oregon Health Authority (OHA) within seven days, and lead poisoning within one working day. Local health departments are usually the “first responders” to act on elevated BLLs through an investigative role.* Once a confirmed elevated BLL report is received, case management protocols are activated. These typically involve an interview,

using the [Elevated Blood Level Initial Environmental Investigation Report](#), along with a home investigation. The goal of these activities is to identify probable lead sources and provide education and resources on reducing or eliminating future exposure.

Home-visiting nurses, environmental health specialists, and WIC staff provide follow-up visits, risk reduction education, and access to nutrition and health resources. These individuals can also begin the referral process for [Early Intervention/Early Childhood Special Education services](#), which provide services for children with developmental delays.

THE ROLE OF CLINICIANS

Clinicians play a vital role in identifying children with elevated BLLs through screening children at appropriate ages or who are determined to be at high risk. Screening and testing children for lead should be based on the OHA’s [lead poisoning investigative guidelines](#)[†] and adhere to the [federal requirements](#) for universal testing of Medicaid/Oregon Health Plan (OHP)-enrolled children.

In short, children not on OHP should be screened using the [Lead Screening Questionnaire](#) at 12 months and again at 24 months of age, or between 3 and 5 years of age if not previously screened. Children enrolled in OHP **must** receive blood lead testing at 12 months and at 24 months of age, or before age 6 years if there is no record of previous blood lead testing. Unfortunately, in 2016 only 15% of OHP members 9–23 months of age had received blood testing. The Oregon Public Health Division is currently conducting a survey of primary care providers to learn about childhood lead screening practices and barriers to following these schedules.

Clinicians doing point-of-care blood lead testing are required to report all blood lead test results directly to their local health department or OHA.[†] Clinicians also provide follow-up care and testing to ensure the reduction of BLLs and eventual closure of the case, which is met with two consecutive blood tests below 5 µg/dL at a 3-month interval. Successive reductions in BLLs will also confirm successful identification

and removal of probable exposure sources. When follow-up testing shows an increase in BLLs, providers should work with local public health departments to determine next steps, which could include additional family education, follow-up home visits, or other strategies to ensure identification of exposure sources and remedial actions.

RESOURCES

- Toxicology experts at the [Oregon Poison Center](#) or the [NW Pediatric Environmental Health Specialty Unit](#) (PEHSU) are available to consult on the diagnosis and treatment of children with lead poisoning (or exposures to other environmental toxins, for that matter).
- Oregon’s Lead Prevention Program website ([www.healthoregon.org/lead](#)) is another source of information and tools. OHA will be collaborating with PEHSU to bring CME-eligible trainings on lead poisoning prevention, testing, and treatment to various locations in Oregon starting in the early 2019.
- The American Academy of Pediatrics also has [lead screening guidelines](#) as part of its Bright Futures initiative.⁷

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* Oregon Administrative Rules Chapter 333, Division 19. [https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1234](#).

[†] Oregon Lead Poisoning Investigative Guidelines. [www.oregon.gov/oha/PH/HealthyEnvironments/HealthyNeighborhoods/LeadPoisoning/CountyHealthDepartments/Documents/Diseaseguidelines.pdf](#)



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