



# Blood Lead

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## Disease Plan

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Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.

## ✓ WHY IS BLOOD LEAD IMPORTANT TO PUBLIC HEALTH?

Lead poisoning is the most significant and prevalent disease of environmental origin among children living in the United States. Despite considerable knowledge, increased screening, and intervention efforts, lead exposure still occurs. In the United States, environmental lead exposure affects up to one million preschool children. Health effects include decreased intelligence, behavioral and speech problems, anemia, decreased muscle and bone growth, poor muscle coordination, and hearing damage. High levels of lead can cause many health problems by damaging the brain, nervous system, and kidneys.

## ✓ DISEASE AND EPIDEMIOLOGY

### Clinical Description

Lead exposure occurs primarily by inhaling or ingesting lead. The most common exposure is ingesting leaded dust.

Lead serves no useful purpose in the human body, but its presence in the body can lead to toxic effects, regardless of exposure pathway.

- Lead toxicity can affect every organ system.
- On a molecular level, proposed mechanisms for toxicity involve fundamental biochemical processes. These include lead's ability to inhibit or mimic the actions of calcium (which can affect calcium-dependent or related processes) and to interact with proteins (including those with sulfhydryl, amine, phosphate and carboxyl groups) (ATSDR, 2005).

It must be emphasized that **there may be no threshold** for developmental effects on children.

- The health care provider can distinguish overt clinical symptoms and health effects that come with high exposure levels on an individual basis. However, lack of overt symptoms does not mean “no lead poisoning.”
- Lower levels of exposure have been shown to have many subtle health effects.
- Some researchers have suggested that lead continues to contribute significantly to socio-behavioral problems such as juvenile delinquency and violent crime (Needleman 2002, Nevin 2000).
- It is important to prevent all lead exposures.

While the immediate health effect of concern in children is typically neurological, it is important to remember that childhood lead poisoning can lead to health effects later in life including renal effects, hypertension, reproductive problems, and developmental problems with their offspring.

### Causative Agent

Lead is a soft, bluish-gray metal. Lead occurs naturally and is found in small amounts in the earth's crust, but much of its presence in the environment stems from its historic use in paint and gasoline,

burning fossil fuels, manufacturing and from ongoing or historic mining and commercial operations. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), devices to shield X-rays, and various other products. Because of health concerns, lead from gasoline, paints, ceramic products, caulking, and pipe solder has been dramatically reduced.

The absorption and biologic fate of lead once it enters the human body depends on a variety of factors, including nutritional status, health, and age.

- Most inhaled lead in the lower respiratory tract is absorbed.
- Most lead that enters the body is excreted in urine or through biliary clearance (ultimately, in the feces).

For the chemical form of lead or lead compounds, entering the body is also a factor for the absorption and biologic fate of lead.

- Inorganic lead, the most common form of lead, is not metabolized in the liver.
- Nearly all organic lead that is ingested is absorbed.
- Organic lead compounds (far rarer today after EPA's ban on gasoline additives containing lead) are metabolized in the liver.

Absorbed lead that is not excreted is exchanged primarily among *three compartments*:

- Blood;
- Mineralizing tissues (bones and teeth), which typically contain the vast majority of the lead body burden; and
- Soft tissue (liver, kidneys, lungs, brain, spleen, muscles, and heart).

## Differential Diagnosis

The differential diagnosis for lead exposure includes growth failure, developmental delays, hyperactivity, behavior disorders, hearing loss and anemia.

## Laboratory Identification

The diagnosis of lead exposure is performed by laboratory analysis of a capillary or venous sample of whole-blood. The blood lead result is presented in the units, “µg/dL” (micrograms per deciliter). All blood lead results are reportable to the Utah Department of Health, Environmental Epidemiology Program.

## Treatment

Protecting children from exposure to lead is important to lifelong good health. No safe blood lead level in children has been identified. Even low levels of lead in blood have been shown to affect IQ, ability to pay attention, and academic achievement. Effects of lead exposure cannot be corrected.

The most important step parents, doctors, and others can take is to **prevent lead exposure**. There are many ways parents can reduce a child's exposure to lead. The most important is stopping children from coming into contact with lead. Lead hazards in a child's environment must be identified and controlled or removed safely.

The medical treatment for children with high blood lead exposure levels is chelation therapy, which is considered when a child has a blood lead test result greater than or equal to 45 µg/dL.

## **Case Fatality**

Death related to lead exposure in the United States is quite rare in children, and is typically from an acute exposure. Blood lead levels  $\geq 70$  µg/dL are considered a medical emergency; in this case, the child should be hospitalized, diagnostic testing should be performed immediately as an emergency lab test, and immediate chelation therapy should be started. In the United States, the last known death of a child related to lead exposure was published in the following Morbidity and Mortality Weekly Report. In 2006, a child age 4 had ingested a metallic charm and his blood lead level was determined to be 180 µg/dL (<http://www.cdc.gov/mmwr/PDF/wk/mm55d323.pdf>).

## **Reservoir**

N/A.

## **Transmission**

There is no person to person transmission, although a woman who is pregnant and is exposed to lead can transfer the lead exposure to the unborn child. Lead has been found to pass through the placental barrier.

## **Susceptibility**

All children under the age of 6 years are at the highest risk, because they are growing rapidly and because they tend to put their hands or other objects, which may be contaminated with lead dust, into their mouths.

Other risk factors include: children living at or below the poverty level who live in older housing; children of some racial and ethnic minority groups, immigrants, and refugees; children living in older, poorly maintained rental properties or who have parents who are exposed to lead at work, or who have hobbies related to lead. These hobbies can bring leaded dust home, exposing family members. Also, women who are pregnant and exposed to lead can transfer the lead exposure to their unborn child.

## **Incubation Period**

NA.

## **Period of Communicability**

NA.

## **Epidemiology**

From 1996 to 2014, Utah's prevalence for children ages 0-5 years, with an EBLL ( $\geq 10 \mu\text{g/dL}$ ), has decreased from 4.0 % to 0.6 %, with the geometric mean decreasing from 3.0  $\mu\text{g/dL}$  to 1.1  $\mu\text{g/dL}$  respectively. Although the rates have been declining, there are areas within the state that have high risk minority populations. Minority groups tend to occupy housing that is less expensive, older, and in closer proximity to industrial or hazardous waste sites. There are an estimated 127,266, pre-1950 housing units throughout Utah and 76% of the units are located in these higher populated communities. The main sources of lead exposure identified in children residing in Utah include lead-based paint, past mining activities, parent's occupation/hobbies, previous exposure (immigrants/refugees) and other non-traditional routes of exposure. The risk factors associated with children identified as having an EBLL include living in a home built prior to 1978; exposure to peeling and chipping paint or remodeling; hand to mouth activity; eating dirt; living or playing near tailings from mining or milling operations; chewing on furniture and toys; regularly visiting a home built before 1960 with peeling and chipping paint or broken plaster; exposure to folk remedies; having parent/guardians with activities of welding, battery or foundry work, radiator and auto repair, refinishing furniture, soldering, painting, or shooting/reloading activities.

## **PUBLIC HEALTH CONTROL MEASURES**

### **Public Health Responsibility**

- Provide educational materials about lead exposures, possible sources of exposure, the health effects, nutrition, and how to protect persons from lead exposures.
- Provide case management for children identified as having an elevated blood lead level, and coordinate an environmental investigation if needed for those with higher blood lead levels (see chart under Case Investigation Process below).

### **Prevention**

It is important to determine the construction year of the house or the dwelling where the child may spend a large amount of time (e.g., grandparents or daycare). In housing built before 1978, assume that the paint has lead unless tests show otherwise. The following guidelines will help reduce lead exposure:

- Talk to the state or local health department about testing paint and dust from the home for lead (Utah Department of Environmental Quality-Lead-Based Paint Program <http://www.deq.utah.gov/ProgramsServices/programs/air/lead>).
- Make sure the child does not have access to peeling paint or chewable surfaces painted with lead-based paint.
- Ensure that pregnant women and children are not present in housing built before 1978 that is undergoing renovation. They should not participate in activities that disturb old paint or in cleaning up paint debris after work is completed.
- Maintain a healthy diet, especially high in calcium and iron.
- Create barriers between living/play areas and lead sources. Until environmental clean-up is completed, parents should clean and isolate all sources of lead. They should close and lock doors to keep children away from chipping or peeling paint on walls. Temporary barriers such as contact paper or duct tape to cover holes in walls or to block children's access to other sources of lead should be implemented.

- Regularly wash children's hands and toys. Hands and toys can become contaminated from household dust or exterior soil. Both are known lead sources.
- Regularly wet-mop floors and wet-wipe window components. Because household dust is a major source of lead, parents should wet-mop floors and wet-wipe horizontal surfaces every 2-3 weeks. Window sills and wells can contain high levels of leaded dust. They should be kept clean. If possible, windows should be shut to prevent abrasion of painted surfaces or opened from the top sash.
- Prevent children from playing in bare soil; if possible, provide them with sandboxes. Parents should plant grass on areas of bare soil or cover the soil with grass seed, mulch, or wood chips if possible. Until the bare soil is covered, parents should move play areas away from the bare soil and away from the house.

**To further reduce a child's exposure from non-residential paint sources:**

- Avoid using traditional folk remedies (<https://www.cdc.gov/nceh/lead/tips/folkmedicine.htm>) and cosmetics that may contain lead;
- Avoid eating candies (<https://www.cdc.gov/nceh/lead/tips/candy.htm>) imported from Mexico;
- Avoid using containers, cookware, or tableware to store or cook foods or liquids that are not shown to be lead free;
- Remove recalled toys (<https://www.cdc.gov/nceh/lead/tips/toys.htm>), (<http://www.cpsc.gov>) and toy jewelry (<https://www.cdc.gov/nceh/lead/tips/jewelry.htm>) immediately from children.
- Use only cold water (<https://www.cdc.gov/nceh/lead/tips/water.htm>) from the tap for drinking, cooking, and making baby formula (hot water is more likely to contain higher levels of lead. Most of the lead in household water usually comes from the plumbing in your house, not from the local water supply.)
- Shower and change clothes after finishing a task that involves working with lead-based products such as stained glass, making bullets, or using a firing range, or working in a lead related occupation;
- Avoid playing on or near tailings from mining or milling operations.

**Chemoprophylaxis**

N/A.

**Vaccine**

N/A.

**Isolation and Quarantine Requirements**

**Isolation:** N/A.

**Hospital:** N/A.

**Quarantine:** N/A.

✓ **CASE INVESTIGATION**

**Reporting**

All blood lead test results are reportable. Cases of elevated blood lead levels include all persons with whole blood lead concentrations  $\geq 10\mu\text{g/dL}$ . Cases shall be reported to the Utah Department of Health or to the local health department responsible for the geographic area where the injury occurred as per Utah Administrative Code R386-703. The rule does not make testing mandatory for all Utah children. Rather, testing is done based on clinical evaluation of need. (The Injury Reporting Rule can be viewed at the following link: R386-703. Injury Reporting Rule: <http://www.rules.utah.gov/publicat/code/r386/r386-703.htm>)

**Case Definition**

A child age 0-5 years old with a blood lead level  $\geq 10 \mu\text{g/dL}$  is considered to have an elevated blood lead level and case management should proceed. (See below - Case Investigation Process)

**Case Investigation Process**

The following chart explains the procedures that should be performed for a child at various blood lead levels:

<b>Utah Blood Lead Follow-up Guidelines</b>					
Lab Reports of Blood Lead Tests performed on Children, ages 0-15 years old, follow guidelines below at the various blood lead level ranges.					
If age 16 years and older - no follow-up is needed at any blood lead level, although if the blood lead level is $\geq 10.0 \mu\text{g/dL}$ , may recommend, if any child and/or if anyone is pregnant in the home, to receive a blood lead test.					
<b>If the Blood Lead Level is:</b>					
<b>&lt; 10.0 <math>\mu\text{g/dL}</math></b>	<b>10.0 - 14.9 <math>\mu\text{g/dL}</math></b>	<b>15.0 - 19.9 <math>\mu\text{g/dL}</math></b>	<b>20.0 - 44.9 <math>\mu\text{g/dL}</math></b>	<b>45.0 - 69.9 <math>\mu\text{g/dL}</math></b>	<b><math>\geq 70.0 \mu\text{g/dL}</math></b>
Provide educational material to parent/guardian	Contact parent/guardian, provide test results	Contact parent/guardian, provide test results and conduct Risk Assessment questionnaire (RA) of Child	Contact parent/guardian, provide test results and conduct RA of Child	Contact parent/guardian, provide test results and conduct RA of Child	Contact child's physician & coordinate for follow-up testing, & for Emergency Medical Intervention
No further action	Contact child's physician for confirmatory test (venous-preferred or capillary) w/in one month of initial test, unless the initial test was a venous test	Contact child's physician for confirmatory test (venous-preferred or capillary) w/in one month of initial test, unless the initial test was a venous test	Contact child's physician for confirmatory test (venous-preferred or capillary) w/in one month of initial test, unless the initial test was a venous test	Contact child's physician for confirmatory test (venous-preferred or capillary) w/in one month of initial test, unless the initial test was a venous test	Contact parent/guardian and conduct RA of Child
	Provide educational material to parent/guardian	Provide educational material to parent/guardian	Provide educational material to parent/guardian	Provide educational material to parent/guardian	Provide educational material to parent/guardian

**Blood Lead:** Utah Public Health Disease Investigation Plan

		If child's blood lead drops < 10 µg/dL	If child's blood lead level persists	Coordinate for an environmental investigation w/in 10 days	Coordinate for an environmental investigation w/in 5 days	Coordinate for an environmental investigation w/in 5 days
		Continue to monitor and test annually	Coordinate for an environmental investigation			
Send reminders to notify physician's office to conduct follow-up testing, every 2-3 months until two consecutive tests are < 10 µg/dL	Send reminders to notify physician's office to conduct follow-up testing, every 2-3 months until two consecutive tests are < 10 µg/dL			Continue to monitor blood lead level, until two consecutive tests are < 10 µg/dL	Continue to monitor blood lead level, until two consecutive tests are < 10 µg/dL	Continue to monitor blood lead level, until two consecutive tests are < 10 µg/dL

**Outbreaks**

N/A.

**Identifying Case Contacts**

N/A.

**Case Contact Management**

N/A.



## ✓ REFERENCES

**Utah Environmental Public Health Tracking Program (UEPHTP):**  
(<http://epht.health.utah.gov/epht-view/topic/ChildhoodBloodLead.html>)

**Centers for Disease Control and Prevention (CDC):**  
([http://www.cdc.gov/nceh/lead/ACCLPP/blood\\_lead\\_levels.htm](http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm))

- **Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention:**  
([http://www.cdc.gov/nceh/lead/casemanagement/casemanage\\_main.htm](http://www.cdc.gov/nceh/lead/casemanagement/casemanage_main.htm))

**Agency for Toxic Substances & Disease Registry (ATSDR):**  
(<http://www.atsdr.cdc.gov/csem/csem.asp?csem=7&po=0>)

**U.S. Environmental Protection Agency, Lead Awareness Program**  
(<http://www.epa.gov/lead>)

## ✓ VERSION CONTROL

01.11.15: New Disease Plan

## ✓ UT-NEDSS Minimum/Required Fields by Tab

### Demographic

- List fields here

### Clinical

- List fields here

### Laboratory

- List fields here

### Epidemiological

- List fields here

### Investigation

- List fields here

### Contacts

- List fields here

### Reporting

- List fields here

### Administrative

- List fields here