

Elevated Blood Lead

Important Notice:

All public health recommendations for routine investigations are based on “Control of Communicable Diseases Manual, 20th edition, 2015” (CCDM) unless otherwise stated. Use the CCDM as the primary resource for case investigations that meet routine follow up. In cases of complicated situations or unique issues not addressed by this manual, please refer to the Administrative Rules of Montana (ARM) Chapter [37.114](#) or contact the designated subject matter expert in the Office of Epidemiology and Scientific Support at the Montana DPHHS for further clarification.

PROTOCOL CHECKLIST

- Confirm diagnosis, see case definition (see section 3.3 and 4.1)
- Review background information on elevated blood lead (see section 2)
- Contact provider to determine a plan to re-test blood lead level
- Notify state health department of the case by entering available information into the Montana Infectious Disease Information System (MIDIS), if available, within the time frame for the specific disease per (ARM) [37.114.204](#) (see section 1.3)
- Review for use, specific technical assistance guidance documents ([See the CDEpi Resources Page](#))
- Interview patient/guardian, cover the following:
 - Review health consequences of an elevated blood lead facts with patient/guardian (see section 2.2)
 - Ask about exposures to relevant risk factors and to determine the risk of exposure for other household members (see section 4.3)
 - Educate patient/ guardian on lead exposure prevention (see section 6)
 - Implement Control Measures (see section 5.1)
 - Address patient’s/guardian’s questions or concerns
 - Determine answers to “condition specific” questions at the end of each MIDIS investigation
- Follow-up on special situations (see section 5, review references and additional information or contact the Epidemiology and Scientific Support Bureau at 406-202-8866)
- Attach any additional lab reports to case investigation in MIDIS
- When done with MIDIS investigation, close the investigation.

1 DISEASE REPORTING

1.1 Provider notification to Public Health Authorities

Any person, including, but not limited to a physician, dentist, nurse, medical examiner, other health care practitioner, administrator of a health care facility or laboratory, public or private school administrator, or laboratory professional who knows or has reason to believe that a case exists of a reportable disease or condition defined in the Administrative Rules of Montana (ARM) [37.114.203](#) must immediately report to the local health officer. The following laboratory tests are reportable:

- Lead levels in a capillary blood specimen of ≥ 3.5 micrograms per deciliter ($\mu\text{g}/\text{dL}$) in a person less than 16 years of age
- Lead levels in a venous blood specimen at any level

For more information on analysis and specimen collection please contact the laboratory conducting the test or the Montana Public Health Laboratory (MTPHL) at 1-800-821-7284. The MTPHL Laboratory Services Manual can be accessed <https://dphhs.mt.gov/publichealth/LaboratoryServices/PublicHealthLabTestingI>

1.2 Local Health Department Follow-up Responsibilities

Immediately after being notified of a case of a reportable condition, a local health officer must investigate per (ARM) [37.114.546](#) and [37.114.205](#). See section 4.3 below.

1.3 Local Health Department Reporting to State Public Health Authorities

Toxic Metals exposures involving Lead (Pb), Arsenic (As), Cadmium (Cd), or Mercury (Hg) greater or equal the State reference value per REPORTABLE DISEASES AND CONDITIONS [ARM 37.114.203\(1\)\(e\), \(i\), \(aj\), and \(au\)](#) must be reported to DPHHS regardless of patient age.

Per [ARM 37.114.204 2\(b\)](#), a local health officer must transmit by telephone or secure electronic means to the department the information required by ARM 37.114.205(1) and (2) for each suspected or confirmed case in a patient with a blood lead level at or above 3.5 micrograms per deciliter ($\mu\text{g}/\text{dL}$) within seven (7) days of learning of the condition.

2 THE DISEASE AND ITS EPIDEMIOLOGY

2.1 Public Health Significance in Montana

The DPHHS Montana Health Homes Lead Poisoning Prevention Program conducted a field study of blood lead levels in children under six (6) years of age in 2012 and estimated that 3% of children enrolled in Medicaid had a blood lead at or above 5 $\mu\text{g}/\text{dL}$, the blood lead reference value at that time. Today, little is known about the burden of lead exposure among children and adults living in Montana from sources of lead in houses, worksites, and other community locations.

Nationally, childhood lead poisoning is a major, preventable environmental health problem. According to the CDC, at least four million households have children living in them that are exposed to high levels of lead. There are approximately half a million U.S. children ages 1–5 years with blood lead levels above 3.5 µg/dL, the reference level at which CDC recommends public health actions be initiated.

In 2013, the CDC National Institute for Occupational Safety and Health (NIOSH), Adult Blood Lead Epidemiology and Surveillance (ABLES) program determined the prevalence of adult workers with a blood lead level equal to or greater than ten (10) micrograms per deciliter in the US was 20.4 adults per 100,000 employed adults. According to ABLES, most lead exposures among adults are due to occupational exposures in four major industry categories (NAICS): 1. Manufacturing (i.e., battery manufacturing, metal fabrication), 2. Construction (i.e., residential construction, painting/wall covering, roads/bridges), 3. Services (i.e., environmental remediation, mechanical, electrical, recreational), and 4. Mining (copper, nickel, lead, zinc).

Health experts agree that there is no safe level of lead in blood. In 2021, the Centers for Disease Control and Prevention (CDC) updated the Blood Lead Reference Value (BLRV), decreasing it from 5 to 3.5 µg/dL for children based on the National Health and Nutritional Examination Survey (NHANES) data from its 2015-2016 and 2017–2018 cycles. The CDC also determined the 97.5% percentile level for blood lead in adults, using NHANES as 3.49 µg/dL; subsequently, the BLRV for adults was also lowered from 5 to 3.5 µg/dL.

The National Toxicology Program (NTP) concluded in 2012 that after reviewing the primary epidemiological literature regarding low-level lead exposure the evidence provides support for adverse health effects in both children and adults at blood lead levels below 10 µg/dL, and for some effects, below 5µg/dL (NTP, 2020). There is no safe level of lead in blood. Even low levels of lead in blood have been shown to affect an individuals' cognitive and physical health, resulting in behavior problems, lower academic achievement, and chronic kidney and cardiovascular diseases. The effects of lead exposure can be permanent. The most important action that parents, employers, doctors, and others can take is to prevent lead exposure before it occurs.

2.2 Clinical Description of Illness

According to the CDC, lead poisoning often occurs with no obvious symptoms and frequently goes unrecognized. Lead poisoning can cause learning disabilities, behavioral problems, and, at very high levels, seizures, coma, and even death.

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure and anemia, particularly in middle-aged and older people. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In

pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, and decreased mental ability in the infant, and learning difficulties and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

3 CASE DEFINITION

3.1 Clinical Description

See Section 2.2.

3.2 Laboratory Criteria for Diagnosis

Confirmed

- Detection of lead in a venous blood specimen from a person of any age that is at or above the reference value of 3.5 µg/dL.
- Detection of lead in two capillary blood specimens from a child less than 16 years old at or above the reference value of 3.5 µg/dL that are collected within 12 weeks of each other.

Supportive laboratory evidence

- Detection of lead in a single capillary blood specimen from a child less than 16 years old that is at or above the reference value of 3.5 µg/dL, OR
- Detection of lead in two capillary blood specimens from a child less than 16 years old at or above the reference value of 3.5 µg/dL that are collected after 12 weeks of each other.

3.3 Case Classification

Confirmed

- Meets the confirmatory laboratory criteria for diagnosis in Section 3.2.

Suspect:

- Meets the supportive laboratory criteria for diagnosis in Section 3.2.

Comment

The Council of State and Territorial Epidemiologist approved the updated criteria for reporting, the case definition, and case classifications for lead in blood in June 2022. Individuals who meet the confirmed case definition should be counted as a new case only once annually. Many individuals receive more than one blood lead test over time. Children and adults who meet the confirmed case definition for more than one year, should be counted annually if the person was not counted as a confirmed case in the previous calendar year.

4 ROUTINE CASE INVESTIGATION

In accordance with (ARM) [37.114.314](#) conduct an epidemiologic investigation to determine the source and possible lead exposure risks. Refer to the CDC for additional resources related to lead investigation. Determine the information necessary to complete the investigation in MIDIS ([See instructions at CD Epi resources](#))

4.1 Confirm the Diagnosis

Review the laboratory results to confirm the diagnosis. Clinical signs and symptoms are not necessary to confirm elevated blood lead levels.

4.2 Laboratory Requirements

See Sections 1.1 and 1.2.

4.3 Case Investigation

The public health recommendations for this investigation guideline are based on the Administrative Rules of Montana (ARM), the Centers for Disease Control and Prevention, CDC, the Pediatric Environmental Health Specialty Unit, PEHSU; and the US Agency for Toxic Substances and Disease Registry, ATSDR rather than the Control of Communicable Diseases Manual (CCDM). See Section 8 references.

Specific Control Measures

Per ARM [37.114.546](#), “The health officer must gather information about the circumstances and nature of the exposure using forms developed by the department ([See CD Epi Exposure Questionnaire](#)). The local health officer must ensure that the following actions are performed when a blood lead level ≥ 3.5 micrograms per deciliter ($\mu\text{g}/\text{dL}$) is reported. The health officer or health-care provider must provide:

- (a) Counseling about health consequences of lead poisoning;
- (b) Information about ways to eliminate lead exposure; and

(c) Referral of the case and household members potentially at risk of exposure to a health-care provider for additional follow-up and blood-lead testing as appropriate.

4.4 Contact Investigation

Because environmental/occupational lead exposures are ubiquitous and may affect entire families, it should be noted in any individual investigation whether there are additional family members at risk of exposure to lead. If so, those family members should be evaluated for elevated blood lead levels. This applies particularly to pregnant women and young children.

4.5 Environmental Evaluation

See Sections 1.2 and 4.3(b). Conduct an environmental evaluation if an ongoing source of exposure is suspected ([See CD Epi Exposure Questionnaire](#)).

5 CONTROL MEASURES

In accordance with (ARM) [37.114.501](#) and (ARM) [37.114.546](#), utilize the prevention measures indicated in Section 6.2 for this disease. Contact the Epidemiology and Scientific Support Bureau for consultation and questions at 406-202-8866 or the 24-hour line 406-444-0273.

5.1 Case Management

See Section 1.2.

5.2 Contact Management

See Section 4.4.

5.3 Environmental and Occupational Measures

An environmental evaluation is appropriate if an ongoing source of exposure is not identified or if more than one case is associated with a venue, such as an occupational setting. Contact the Epidemiology and Scientific Support Bureau at DPHHS for technical assistance with conducting environmental evaluation at 406-202-8866.

Depending on the situation, Department of Labor and Industry (DLI) may assist with environmental investigations of public entities and the Occupational Safety and Health Administration (OSHA) may assist with private and federal entities. The Billings MT OSHA contact is Art Hazen at 406-247-7494. A public entity is defined as any state or local government or any department, agency, special purpose district, or other instrumentality of one or more state or local governments. Contact Department of Labor and Industry (DLI) with any questions about public entities at 406-444-6543.

The employee should work with their employer to complete a First Report of Injury. The employer is then required to submit the form to the company's worker's compensation insurer. The insurer will determine whether the injury or occupational disease is work-related and compensable. However, if the employee has issues working with their employer to receive compensation, they can contact the DLI at 406-444-6543 or visit their website for more information and resources <http://erd.dli.mt.gov/work-comp-claims>.

5.4 Special Circumstances - Lead testing and screening in newly arrived refugees.

The CDC recommends lead testing all international refugees, immigrants, or asylum seekers upon arriving in the United States due to their higher risk for environmental lead poisoning linked to many sources and products common to their country of origin or hazards encountered after arriving to their new home. See the [CDC resources](#) for a list of many of the country specific consumer products contaminated with lead such as traditional remedies, herbal supplements, spices, candies, cosmetics (i.e., kajal or khol), and jewelries or amulets. Country of origin, country of last residence, and age are strong predictors of elevated blood lead levels among newly arrived refugee children. Specific testing and follow-up guidelines are given for children \leq 16 years of age, youth $>$ 16 years of age, and pregnant and lactating women and girls in the [CDC resources](#).

6 ROUTINE PREVENTION

6.1 Immunization Recommendations

N/A

6.2 Prevention Recommendations

CDC states that lead poisoning is entirely preventable. The key is stopping children and adults from coming into contact with lead and treating children and adults who have been poisoned by lead.

Because lead can cause damage without overt symptoms, monitoring blood lead levels through evidence-based surveillance methods is a vital part of lead poisoning prevention. This is especially important in ‘at-risk’ groups such as pregnant individuals, children enrolled in Medicaid or Medicaid-eligible services like WIC and Head Start, children in the foster care system, international adoptees, individuals with refugee status in the US, and workers. People who re-load shell casings (i.e., ammunitions) or create stained glass are also likely to have high exposures to lead.

Common sources of lead exposure include soil and dust contaminated with lead paint; leaded gasoline; industrial or occupational lead; drinking water contaminated from lead service lines, plumbing or fixtures; hobbies that involve lead; improperly fired ceramic ware for food; imported foods and products: pottery, traditional ceremonial powders and cosmetics, herbal remedies, cocoa, spices, candy, and canned food that may have lead soldering.

The Consumer Product Safety Commission (CPSC) regularly publishes consumer product recalls of commercial products with hazardous levels of lead. Check the CPSC website and subscribe for updates on lead recalls, <https://www.cpsc.gov/Recalls>.

If exposure is through lead paint, instruct individuals to clean hard surfaces with water regularly (using a mop or cloth). Sweeping will not effectively remove the lead and in fact will bring it into the air making it more likely to be absorbed into the lungs.

A diet rich in calcium, vitamin C, and iron will reduce the absorption and effects of lead.

Adults with occupational exposure are reminded to always use safety equipment as directed and talk with employer regarding proper use of equipment. Be sure to wash hands; avoid eating, drinking, and tobacco use in the exposed work area; shower and change out of work clothes when finished with work to prevent tracking lead into the vehicle and home where family members and others may also be exposed. If elevated blood lead levels persist, then consider removal from source at work via re-assignment. OSHA mandated occupational control measures begin at blood lead levels equal to or above 40 micrograms per deciliter ($\mu\text{g}/\text{dL}$) or two blood lead levels greater or equal to 20 micrograms per deciliter ($\mu\text{g}/\text{dL}$) measured 6 months apart. For pregnant people or those who may become pregnant, American College of Occupational and Environmental Medicine (ACOEM) and the National Toxicology Program (NTP) recommend removal from source at work via re-assignment at 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$).

Less common sources of lead are described here:

<https://www.cdc.gov/nceh/lead/prevention/sources.htm>

Prevention guidance in a factsheet for parents

<https://www.cdc.gov/nceh/lead/docs/5things-508.pdf>

A more exhaustive list of potential sources of lead are found here:

<https://www.cdc.gov/nceh/lead/prevention/sources.htm>

US Environmental Protection Agency Education and Outreach materials: *Lead Awareness in Indian Country: Keeping our Children Healthy!* at: <https://www.epa.gov/lead/tribal-lead-curriculum>

7 ESCALATION/ACTIVATION OF EMERGENCY OPERATIONAL PLANNING

These investigation guidelines are designed to assist local health jurisdictions in the steps and actions needed to report, investigate and control reported cases of Lead Poisoning. In the event individual case investigations or other reported cases lead to a cluster of cases by person, time, and place, local health jurisdictions need to contact DPHHS under the Administrative Rules of Montana [37.114.314](#) and [37.114.315](#) so DPHHS can consider emergency operational escalation or activation under the Communicable Disease Annex to the DPHHS Emergency Operation Plan.

7 ACKNOWLEDGEMENTS

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8 REFERENCES AND ADDITIONAL INFORMATION

Resources for Cases involving children and families:

- President’s Task Force on Environmental Health Risks and Safety Risks to Children <https://ptfceh.niehs.nih.gov/activities/lead-exposures/index.htm>
- CDC Lead Website - <http://www.cdc.gov/nceh/lead/>
 - *Summary of Recommendations for Follow-up and Case Management of Children Based on Confirmed* Blood Lead Levels*
 - https://www.cdc.gov/nceh/lead/acclpp/actions_blls.html
 - Resources and guidance documents to support effective childhood lead poisoning prevention programs
 - http://www.cdc.gov/nceh/lead/casemanagement/casemanage_main.htm
 - *The CDC’s Blood Lead Reference Value explained*
 - http://www.cdc.gov/nceh/lead/acclpp/blood_lead_levels.htm
- Montana General Information Manual for Medicaid Providers, Lead testing and screening, 2020. <https://medicaidprovider.mt.gov/manuals/generalinformationforprovidersmanual>
- Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees, 2022. <https://www.cdc.gov/immigrantrefugeehealth/guidelines/lead-guidelines.html#recommendations>
- Update of the Blood Lead Reference Value — United States, 2021. https://www.cdc.gov/mmwr/volumes/70/wr/mm7043a4.htm?s_cid=mm7043a4_w
- *MANAGEMENT OF CHILDHOOD LEAD EXPOSURE*. Pediatric environmental Health Specialty Units (PEHSU), 2021. https://www.pehsu.net/Lead_Exposure.html

Resources for Adult Cases

- “Overlooked: Thousands of Americans Exposed to Dangerous Levels of Lead in Their Jobs” For workers with elevated lead. Scientific American article <http://www.scientificamerican.com/article/overlooked-thousands-of-american-exposed-to-dangerous-levels-of-lead-in-their-jobs/>
- “Lead and your Health” NIH article for people with elevated lead levels https://www.niehs.nih.gov/health/materials/lead_and_your_health_508.pdf
- Recommendations for Medical Management of Adult Lead Exposure: Article for providers <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1849937/>
- Medical Management Guidelines for Lead-exposed adults revised 2007: for Providers to manage adults with elevated lead levels <https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/medguidelines.aspx>

Important references:

- ATSDR CSEM Lead Toxicity. <http://www.atsdr.cdc.gov/csem/lead/docs/lead.pdf>
- National Toxicology Program, United State Department of Health and Human Services. 2020. <https://ntp.niehs.nih.gov/whatwestudy/assessments/noncancer/completed/lead/index.html>
- Mayo Clinic Lead Poisoning Website <http://www.mayoclinic.org/diseases-conditions/lead-poisoning/basics/definition/con-20035487>