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SE.N.S.O.R.

News

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What is a Normal Blood Lead Level?

With the decrease in exposure to lead to the general public after its ban from residential paint in 1978, lead solder in tin cans for food in 1995, and gasoline in 1996 except for fuel in aircraft, racing cars, farm equipment, and marine engines, the average level of lead in the general population has decreased. In 2021, the Centers for Disease Control and Prevention (CDC) updated the Blood Lead Reference Value (BLRV) for children, decreasing it from 5 to 3.5 µg/dL. This reduction was based on the 97.5% percentile level in the general population measured in the 2015-2016 and 2017-2018 National Health and Nutrition Examination Survey cycles (NHANES) (Ruckart PZ, Jones RL, Courtney JG et al. Update of the blood lead reference value - United States, 2021. MMWR 2021 Oct 29; 70(43): 1509-1512). In recognition that there is no safe level of lead and accordingly no “normal” level, CDC no longer uses the term “elevated blood lead level” and, instead, uses “at or above the BLRV”. Subsequently, CDC calculated that the 97.5% percentile level in adults was the same as that for children (Jones, Chief, Inorganic and Radiation Analytical Toxicology Branch CDC personal communication. 1/18/2021).

Though commonly thought of as a problem unique to toddlers from the ingestion of paint chips, lead toxicity is also an important health issue in adults. One of the responses to the Flint Water Lead contamination was that in 2018 Michigan OSHA required that workers be removed from exposure to lead with blood leads ≥ 30 µg/dL, or three consecutive tests or all tests within the last six months > 20 µg/dL, or a detected medical condition which places the worker at an increased health risk from lead exposure. The worker cannot return to lead exposure until their blood lead is < 15 µg/dL. The new MIOSHA standard also eliminated the requirement to perform blood testing for zinc protoporphyrin (ZPP), a hemoglobin precursor increased after exposure to lead. These Michigan standards are in contrast to the rest of the country where the respective numbers are 60, 50 and 40 µg/dL.

Each year in Michigan, ~16,000 individuals ≥ 16 years old are tested for lead exposure. The appropriate test is a venous blood sample for lead. Since all guidelines on treatment and management in adults are based on blood lead levels, a urine test for lead is not useful. See Table 1 for management guidelines for different blood lead levels. Treatment decisions should not be based on urine leads, particularly those done after administration of a chelating agent. There are 14 laboratories that analyze blood lead samples for blood drawn for lead in Michigan patients. At the date of this newsletter, eight have lowered their reference range for adult blood lead levels to 3.5 µg/dL, the other six continue to use a reference range of 5 µg/dL. All use a reference range of 3.5 µg/dL for children.

Approximately 1,400 (~9%) individuals ≥ 16 years old in Michigan each year have an elevated blood lead level (BLL). Among the approximately 1,400 individuals ≥ 16 years old with a BLL ≥ 3.5 µg/dL reported each year in Michigan, about 68% have a BLL of 3.5-9 µg/dL, 25% have a BLL of 10- 19 µg/dL, 5% have a BLL of 20-29 µg/dL and 2% have a BLL of ≥ 30 µg/dL. The percentage where the source of lead exposure is the workplace goes from 84%, to 81% to 79% to 78% in the four BLL categories.

The most common workplace exposures are removal of lead-based paint from outdoor metal structures (e.g. bridges and water towers), manufacture of brass fixtures which may be up to 9% lead, work in indoor firing ranges which usually use lead bullets, and manufacture and recycling of lead storage batteries. The most common non-work exposures involve gun-related hobbies (target practice in indoor ranges or tumbling bullet castings), home remodeling in a building built before 1978, retained bullet fragments after being shot and possible drinking water contamination.

Examples of Exposure to Lead

A male in his 60s with a lead level of 27 µg/dL was exposed to lead through inhalation of lead dust particles after sweeping at an indoor firing range.

A male in his 30s with a lead level 39 µg/dL was exposed to lead while employed at a remediation services company where he did lead paint abatement.

A male in his 40s with a lead level of 70 µg/dL was exposed to lead while employed at an industrial machinery and equipment merchant wholesaler in a battery processing area.

A female in her 70s with a lead level of 11 µg/dL was exposed to lead after chipping and scraping lead paint from an old baby crib.

A male in his 30s with a lead level of 7 µg/dL was exposed to lead from consumption of spices from India.

A male in his 90s with a lead level of 10 µg/dL was exposed to lead through use of lead containing airplane fuel to clean his hands.

A female in her 70s with a lead level of 9 µg/dL was exposed to lead through contact with shooting range clothing worn by her spouse.

Eleven individuals, age 21-66, had blood levels of 4 to 33 µg/dL from a retained bullet after a previous gunshot wound.

New educational brochures and resources on lead for patients:

Working Safely with Lead: <https://oem.msu.edu/images/resources/ABLES/WorkingSafelyWithLead.pdf>

Lead Hazards at Indoor Firing Ranges: <https://oem.msu.edu/images/resources/ABLES/IndoorFiringRanges.pdf>

Lead Hazards from Casting and Reloading:

https://oem.msu.edu/images/resources/ABLES/LEAD_HAZARDS_FROM_CASTING_BULLETS.pdf

If you or a patient are concerned about lead exposure, you can order a venous blood sample, which will be processed by the laboratory you normally send patients to for a blood draw. Two comprehensive reviews of lead-related health effects are:

1. National Toxicology Program. NTP Monograph on health effects of low-level lead. June 2012.
https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead_newissn_508.pdf
Accessed 9/23/2022.

2. ATSDR. Toxicological Profile for Lead August 2020.
<https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=96&tid=22> Accessed 9/23/22.

If you have questions about the diagnosis or management of an elevated lead level in a patient, Kenneth Rosenman MD can be reached at rosenman@msu.edu or 1-800-446-7805.

Table 1. MANAGEMENT GUIDELINES FOR BLOOD LEAD LEVELS IN ADULTS

The following categories represent general guidelines. Blood Lead Level (BLL) monitoring should be done on a schedule based on an individual’s risk of exposure to lead. **Primary management of lead poisoning is source identification and the elimination or reduction of further exposure.** A single BLL does not reflect cumulative body burden, nor predict long-term effects. Recent evidence suggests that chronic low-level lead exposure has adverse health effects in adults and no blood lead threshold level for these effects has been identified. Treatment decisions, including chelation, should be made in consultation with a physician knowledgeable about lead poisoning medical management.

Blood Lead Level (µg/dL) Management Recommendations

<3.5	No action needed Monitor BLL if ongoing exposure
3.5-9	Discuss health risks Minimize exposure Consider removal for pregnancy and certain medical conditions Monitor BLL
10-19	Decrease exposure Remove from exposure for pregnancy Consider removal for certain medical conditions or BLL > 10 for an extended period of time Monitor BLL
20-29	Remove from exposure for pregnancy Remove from exposure if repeat BLL in 4 weeks remains > 20 Annual lead medical exam recommended
30-49	Remove from exposure Prompt medical evaluation
50-79	Remove from exposure Prompt medical evaluation Consider chelation with significant symptoms
> 80	Remove from exposure Urgent medical evaluation Chelation may be indicated

Note: The above management guidelines recommend removal from lead exposure at blood lead levels that are lower than those at which Medical Removal Protection is required under the current OSHA lead standards. However, OSHA job protections also apply whenever a licensed health care provider removes an individual from lead exposure, regardless of the patient’s blood lead level, if the individual has a lead-related problem or has a medical condition that places the worker at greater risk from lead exposure. Because of the complexity in recommending medical removal below levels required by OSHA, a physician making such a recommendation may want to review the OSHA regulations, consult with a physician familiar with the regulatory process and discuss with their patient how this may affect their employment. For further information on this topic, please see the medical removal protection provisions of the OSHA lead standards.

Adopted Council State and Territorial Epidemiologists Occupational Subcommittee, 12/2/21

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News

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In this issue: V33n4: What is a Normal Blood Lead Level?

*PS Remember to report all cases of occupational disease!

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