

# Blood Lead Screening Guidelines For Pregnant & Breastfeeding Women in Minnesota

Issued August 2015

For more information, please contact:

Environmental Health Division

Environmental Surveillance and Assessment Section

Minnesota Department of Health

P.O. Box 64975    St. Paul, MN 55164-0975    Phone: 651-201-4620    Fax: 651-201-4909

As requested by Minnesota Statute 3.197: This report cost approximately \$5,000 to prepare, including staff time, printing and mailing expenses.

To obtain this information in a different format, call 651-201-4620  
Printed on recycled paper.

# [Acknowledgements]

Funding for the creation of these guidelines was provided by the Centers for Disease Control and Prevention (CDC) Childhood Lead Poisoning Prevention Grant CDC-RFA-EH14-1408PPHF14.

Blood Lead Screening Guidelines for Pregnant and Breastfeeding Women Workgroup:

- Elisha Harris, RN, BSN, PHN, Minnesota Department of Health
- Hanna Henscheid, MPH, City of Minneapolis Health Department
- Adrienne Landsteiner, PhD, MPH, Minnesota Department of Health
- Amy Langenfeld, APRN, PHN, MS, CNM, SANE-A, Indian Health Board of Minneapolis
- Sandy Lien, Medica
- Ruth Lynfield, MD, Minnesota Department of Health
- Katie Martin, APRN, MS, CNM, Minnesota Affiliate of ACNM
- Laurel Ries, MD, Minnesota Medical Association
- Dan Symonik, PhD, MS, Minnesota Department of Health
- Cecilia Wachdorf, APRN, CNM, PhD, Minnesota Department of Health
- Stephanie Yendell, DVM, MPH, Minnesota Department of Health

These guidelines have been reviewed and approved by:

- Local Public Health Association of Minnesota (LPHA)
- Minnesota Affiliate of the American College of Nurse Midwives (ACNM)
- Minnesota Medical Association (MMA)
- Minnesota Section of the American Congress of Obstetricians and Gynecologists (ACOG)



# [Contents]



<b>02</b>	<b>Executive Summary</b>
<b>03</b>	<b>Lead Poisoning During Pregnancy and Breastfeeding</b>
<b>03</b>	Health Effects of Lead Exposure
<b>03</b>	Clinical Indications for Blood Lead Testing
<b>04</b>	<b>Sources and Prevention</b>
<b>04</b>	Sources of Lead Exposure
<b>04</b>	Lead-Related Occupations and Industries
<b>04</b>	Lead-Related Hobbies
<b>05</b>	Traditional or Alternative Remedies and Cosmetics
<b>07</b>	Renovation of Older Homes
<b>07</b>	Food and Water
<b>08</b>	Pica Behavior
<b>08</b>	Other Sources of Lead
<b>09</b>	Lead Poisoning Prevention
<b>10</b>	<b>Identification of Lead Exposure</b>
<b>10</b>	Blood Lead Testing
<b>11</b>	Methods for Blood Lead Test Collection and Analysis
<b>11</b>	Transmission of Blood Lead Test Results
<b>11</b>	Methods to Reduce Elevated Blood Lead Levels in Pregnant Women
<b>12</b>	Nutritional Information
<b>13</b>	<b>Management of Lead Exposure</b>
<b>13</b>	Blood Lead Level Actions
<b>15</b>	Management at Time of Delivery
<b>15</b>	Chelation of Pregnant Women, Fetuses, and Newborn Infants
<b>16</b>	Breastfeeding Recommendations for Women with Elevated Blood Lead Levels
<b>17</b>	<b>Selected Resources</b>

# [Acronyms & Abbreviations]

Blood lead level	<b>BLL</b>
Centers for Disease Control and Prevention	<b>CDC</b>
Food and Drug Administration	<b>FDA</b>
Minnesota Department of Health	<b>MDH</b>
Minnesota Occupational Safety and Health Administration	<b>MNOSHA</b>
Occupational Safety and Health Administration	<b>OSHA</b>
Pediatric Environmental Health Specialty Unit	<b>PEHSU</b>
Supplemental Nutrition Assistance Program	<b>SNAP</b>
Micrograms of lead per deciliter of blood	<b>µg/dL</b>



# 1 [Executive Summary]

## YOU SHOULD KNOW

Exposure to lead affects persons of all ages. Lead exposure during pregnancy is of particular concern because lead can be passed to the developing fetus during pregnancy or to the infant during breastfeeding.

Lead exposure remains an important environmental health issue in Minnesota. Exposure to lead affects persons of all ages. Lead exposure during pregnancy is of particular concern because lead can be passed to the developing fetus during pregnancy or to the infant during breastfeeding and compromise cognitive development. Many sectors work together to prevent exposure of pregnant women to lead, and to quickly identify and respond to exposures that do occur.

During the past several decades, average blood lead levels in the United States have decreased dramatically. This represents a great public health success. Unfortunately, elevated blood lead levels still occur. For adults, occupational exposures to lead remain a problem, and although the Occupational Safety and Health Administration (OSHA) issued standards for lead exposure in the workplace in 1978, those standards have not been updated as the body of scientific knowledge has evolved. In addition, lead can be found in some consumer products and other sources discussed in this document. Work needs to continue to prevent these exposures.

The Minnesota Department of Health (MDH) worked in collaboration with the Blood Lead Screening Guidelines for Pregnant and Breastfeeding Women Workgroup to develop these guidelines. They serve to update guidelines issued by MDH in 2004. They are intended to supplement the 2010 CDC Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women by providing a concise set of recommendations specific to Minnesota.

## 2 [Lead Poisoning During Pregnancy & Breastfeeding]

### Health Effects of Lead Exposure

Lead exposure has been associated with a number of health effects in persons of all ages. There is no known safe level of exposure to lead.<sup>1</sup> Lead in the bloodstream of a pregnant woman can be transferred to the fetus.<sup>1</sup> Therefore, elevated blood lead levels in pregnant women are a health concern for both mother and child.

During pregnancy, lead exposure has been associated with increased risk of gestational hypertension. The level of exposure to lead at which risk for gestational hypertension increases is unclear.<sup>1</sup> At blood lead levels  $\geq 30$   $\mu\text{g}/\text{dL}$ , the risk for spontaneous abortion increases; preliminary evidence suggests the risk for spontaneous abortion may also increase at blood lead levels below 30  $\mu\text{g}/\text{dL}$ .<sup>1</sup>

Studies of prenatal exposure to lead on the health of infants and children are limited. However, studies suggest an inverse relationship between maternal blood lead levels and neurobehavioral development of the child, even at maternal blood lead levels below 10  $\mu\text{g}/\text{dL}$ .<sup>1</sup> Breast milk can serve as a postnatal source of lead exposure in breastfed infants.<sup>1,2</sup> There are also numerous health benefits to breastfeeding, such as reductions in the incidence of infections and chronic diseases, as well as increased mother-child bonding. The breastfeeding recommendations for women with elevated blood lead levels on [page 16](#) provide guidance for weighing the benefits and risks of breastfeeding when lead exposure through breast milk is a concern.

### Clinical Indications for Blood Lead Testing

Most women with elevated blood lead levels will be asymptomatic. When symptoms do occur, they are often nonspecific, and may include constipation, abdominal pain, anemia, headache, fatigue, or hypertension. Acute illness from high levels of exposure to lead may cause seizures and may be life-threatening. The decision to conduct blood lead testing in a pregnant woman is typically based on the presence of risk factors for lead exposure rather than signs or symptoms.

#### STUDIES HAVE SHOWN

At blood lead levels  $\geq 30$   $\mu\text{g}/\text{dL}$ , the risk for spontaneous abortion increases; preliminary evidence suggests the risk for spontaneous abortion may also increase at blood lead levels below 30  $\mu\text{g}/\text{dL}$ .

# 3 [Sources & Prevention]

## Sources of Lead Exposure

For adults in the United States, occupational exposure is the primary source of elevated blood lead levels.<sup>3</sup> Recent immigration and certain cultural practices, including the use of alternative medicines or herbal remedies, imported cosmetics, and traditional lead glazed pottery, are also major contributing factors to lead exposure among pregnant women.<sup>3,4</sup> Other factors associated with elevated blood lead levels among adults include lead-related hobbies, pica behavior, high levels of lead in drinking water, retained bullets, and remobilization of lead accumulated in bone from historic exposures.<sup>3,4</sup> Generally, the presence of lead-based paint in the home is less of a concern for adults than for children. However, renovation or remodeling of homes built prior to 1978 can generate substantial amounts of lead-containing dust and is an important source of lead exposure for adults.

## Lead-Related Occupations and Industries

Lead is used in a variety of industries, creating the potential for pregnant women to be exposed to lead while at work. Women and children may also be exposed to lead dust if it is carried home from the workplace on the clothing, shoes, or body of a household member who works with lead. Common industries where lead exposure may occur are listed in [Table 1](#).<sup>5</sup> However, this should not be considered an exhaustive list of all potential occupational lead sources.

Workers have a right to a safe working environment under federal and state laws. Women who are pregnant or planning to become pregnant may have access to additional workplace accommodations. To obtain information on employee workplace rights under the Minnesota Occupational Safety and Health Administration (MNOSHA), call the MNOSHA Workplace Safety Consultation line at 1-800-DIAL-DLI (1-800-342-5354).

## Lead-Related Hobbies

In addition to occupational sources, hobbies can also be a source of lead exposure. Often, hobbies are performed in or around the home, leading to increased opportunities for family members to be exposed.

Several of the occupations listed in [Table 1](#) can also be performed as hobbies.

### YOU SHOULD KNOW

In the United States, occupational exposure is the primary source of elevated blood lead levels. Recent immigration and certain cultural practices are also major contributing factors to lead exposure among pregnant women.



Additional hobbies that may lead to lead exposure include collecting or restoring antiques that have lead-based paint, casting lead figurines, and the German tradition of Bleigiessen, which involves dropping molten lead into cold water to make predictions about the future.

**Table 1. Examples of Lead-Related Occupations and Industries**

- Artists, including painters, ceramics makers, jewelry makers and repairers, stained glass makers, and print makers (materials used may contain lead)
- Auto repairers (car parts may contain lead)
- Battery manufacturers (batteries contain lead)
- Bridge reconstruction workers (old paint may contain lead)
- Construction workers (materials used may include lead)
- Demolition workers
- Firing range workers and gunsmiths (ammunition contains lead)
- Glass manufacturers (lead may be used in glass production)
- Lead abatement workers
- Lead manufacturers
- Lead miners
- Lead refiners
- Lead smelters
- Manufacturers of bullets, fishing sinkers, ceramics, industrial machinery, and electrical components (all may contain lead)
- Painters (old paint and commercial paint may contain lead)
- Paint and pigment manufacturers
- Plastic manufacturers (materials made may contain lead)
- Plumbers and pipe fitters (pipes may contain lead)
- Police officers and armed forces members (ammunition contains lead)
- Radiator repairers (radiators may contain lead)
- Recyclers of metal, glass, electronics, and batteries (may contain lead)
- Remodelers, repainters, and renovators of houses or buildings
- Restorers or refinishers of antique products/furniture
- Rubber product manufacturers (process contains lead)
- Shipbuilders (materials used may include lead)
- Solid waste incinerator operators (waste may contain lead)
- Splicers, manufacturers, and strippers of cable or wire
- Steel welder (galvanized steel is coated in part with lead)

### **Traditional or Alternative Remedies and Cosmetics**

Numerous studies and reports have associated a variety of traditional, herbal, or alternative medicines with exposure to lead.<sup>1,3,6</sup> Traditional remedies with extremely high levels of lead have been identified, and several fatalities have been reported following consumption of contaminated products. Some products, such as Ayurvedic (Hindu traditional medicine) preparations made in the rasa shastra tradition may have heavy metals or minerals added intentionally for their purported therapeutic effects.

Products may be imported or purchased in the United States. However, the country of origin cannot be used as an indicator of product safety. One study found that 19% of randomly selected Ayurvedic medications ordered online contained detectable levels of lead.<sup>6</sup> It is important to recognize that traditional remedies may be culturally important to individuals. It is also important to note that use of traditional or alternative remedies is not confined to immigrant communities. Common examples of products that have been associated with lead contamination are listed in Table 2. However, lead has been detected in many products; this is not an all-inclusive list.

**Table 2. Examples of Traditional and Alternative Remedies and Products Associated with Lead Contamination**

Community Known to Use Product	Product Name	Product Use	Product Description
Asian, African, and Middle Eastern Communities	Alkohol, kajal, kohl, tiro, or surma	<ul style="list-style-type: none"> <li>• Cosmetic</li> <li>• Treating skin infections</li> </ul>	Black powder
West African Communities	Calabash chalk, calabash clay, nzu, poto, calabar stone, ndom, mabele, argile, or la craie	<ul style="list-style-type: none"> <li>• Treating morning sickness</li> </ul>	Pellets resembling clay or mud
Chinese Communities	Ba-baw-san	<ul style="list-style-type: none"> <li>• Treating colic</li> </ul>	Herbal medicine
	Bo Ying Compound	<ul style="list-style-type: none"> <li>• Treating respiratory symptoms</li> </ul>	Gray powder
Hmong Communities	Pay-loo-ah	<ul style="list-style-type: none"> <li>• Fever</li> <li>• Rash</li> </ul>	Orange/red powder
South Asian and Indian Communities	Sindoor or kumkum	<ul style="list-style-type: none"> <li>• Topical use as bindi dot or to signify marriage status</li> </ul>	Red powder
	Ghasard/ghazard	<ul style="list-style-type: none"> <li>• Promote digestion</li> </ul>	Brown powder
	Ayurvedic medicines	<ul style="list-style-type: none"> <li>• Variety of uses</li> </ul>	Variety of forms
Burmese Communities	Daw tway	<ul style="list-style-type: none"> <li>• Promote digestion</li> </ul>	Brown pellet or powder
Hispanic Communities	Azarcon, alarcon, greta, cora, coral, liga, maria lusia, or rueda	<ul style="list-style-type: none"> <li>• Abdominal pain (empacho)</li> </ul>	Yellow/orange powder
	Litargirio	<ul style="list-style-type: none"> <li>• Treating burns</li> <li>• Treating fungal skin infections</li> <li>• Deodorant</li> </ul>	Yellow/peach powder

## Renovation of Older Homes

Living in a home built before 1978 that is undergoing renovation may lead to elevated blood lead levels.<sup>3,4</sup> Adults typically have less exposure to lead-based paint dust in the home than children because children spend time crawling and exhibit hand-to-mouth behavior that increases their exposure. However, renovation creates large amounts of dust, which can lead to inhalation exposures in adults. Certain renovation practices, such as dry-sanding paint and using heat guns above 700°F to remove paint are particularly dangerous and commonly cause lead exposures.

## Food and Water

Dietary sources of lead are rare in the United States. Consumption of game meat harvested with lead ammunition can be a source of lead exposure. Lead bullets can fragment extensively, with fragments from some types of lead bullets being detected up to 18 inches from the exit wound.<sup>7</sup> Therefore, trimming away the meat around the wound channel is not sufficient to prevent lead exposure. MDH recommends that pregnant women not consume game harvested with lead bullets. Lead contamination has also led to recalls of some spices and product warnings about candies imported from Mexico.

Food that is cooked or stored in lead-glazed pottery or leaded crystal can be a source of lead exposure. Lead-glazed pottery is more likely to leach lead into food when it is fired at lower temperatures, and when the food cooked is acidic or cooked for long periods of time. The Food and Drug Administration (FDA) has regulations for labeling lead-glazed pottery as not for use with food.<sup>8</sup> However, some imported or handmade products may not comply, and the use of heirloom cookware is common. The use of lead-glazed cookware is especially common among women of Hispanic origin, particularly among women from Mexico. An example of a lead-glazed bean pot that was used by a family in Minneapolis is shown in Figure 1.

Food grown in lead-contaminated soils can also be a source of lead exposure. Soils may be contaminated because of lead-based paint that has chipped off of houses or fences; from car emissions that occurred during years when leaded gasoline was used, or from current or former industrial emissions. More information for home gardeners on identifying and remediating lead in soil can be found on the MDH Lead and Gardening Fact Sheet: <http://www.health.state.mn.us/divs/eh/lead/fs/leadandgardening.html>.

Municipal water supplies and private wells in Minnesota are not generally a substantial source of lead. However, plumbing systems, particularly in homes built before 1985, may contain lead that can dissolve into the water. Letting cold water run for a minute or two before using water for drinking or cooking flushes dissolved lead out of the system. Water can also be tested if there is a concern about lead contamination. More information on lead in drinking water can be found at: <http://www.health.state.mn.us/divs/eh/water/factsheet/ncom/lead.pdf>



### Pica Behavior

Pica is the deliberate ingestion of nonfood items. Pica is a common practice in some parts of Africa, Asia, and Central America. When pica behavior includes the ingestion of substances such as lead-contaminated soils or lead-glazed pottery, blood lead levels can become elevated.<sup>4</sup>

### Other Sources of Lead

A variety of other sources of lead have been identified:

- **Retained bullets** from past gunshot wounds may cause elevated blood lead levels
- **Lead stored in bones** from previous lead exposures can also be mobilized during late pregnancy and lactation in response to low calcium intake at a time when there is an increased need for calcium.<sup>4,9</sup> In addition, after bone mass peaks in early adulthood, bone loss begins which will include lead if there has been historic exposure. The half-life of lead in bone is about 30 years.
- Women who have recently moved from or spent substantial time in **another country** may have greater risk for lead exposure, depending on the environmental regulations and sources of exposure in that country.



Figure 1. Lead-glazed bean pot used by a family in Minneapolis. Photo credit: Hanna Henscheid, City of Minneapolis Health Department

## Lead Poisoning Prevention

For adult women, lead poisoning prevention efforts focus on identifying potential sources of lead and providing education about those sources:

- For exposures to lead in the workplace, the MNOSHA Workplace Safety Consultation line can be contacted at [1-800-DIAL-DLI \(1-800-342-5354\)](tel:1-800-DIAL-DLI). Precautions should be taken to reduce inhalation or ingestion of lead, such as using respiratory protection if indicated, changing out of work clothes and shoes and showering before getting in one's vehicle or going home, washing work clothes separately from other clothing or having work clothes laundered at work, washing hands frequently, not smoking or eating in areas where lead may be present, and reducing unnecessary exposure to lead.
- For women who live with someone who works with lead, household members should be encouraged to reduce take-home lead by following the steps above. This helps protect all family members.
- For women who engage in hobbies that involve lead, hobbies should be performed in well-ventilated areas and away from areas to which children have access. The steps above for reducing occupational exposure should be followed.
- Women should be discouraged from using high-risk traditional remedies and cosmetics, while keeping in mind that these products may be culturally important.
- Pregnant women and young children should not consume game harvested with lead bullets; alternatives include use of non-lead ammunition, bows and arrows, or consumption of other protein sources.
- Any pottery or crystal used for cooking or storing food should be lead-free, and heirloom or antique cookware should not be used.
- When gardening in urban areas, near old buildings that may have been painted with lead, or in other potentially contaminated sites, test soil for contaminants or build raised beds and use clean soil. For more information on lead and gardening, visit <http://www.health.state.mn.us/divs/eh/lead/fs/leadandgardening.html>
- Only water from the cold tap should be used for cooking or drinking. Running tap water for 1–2 minutes will flush out lead that has leached into the water from plumbing.
- Pica behavior should be identified and managed to prevent exposure to substances containing lead
- Lead-safe work practices should be used when renovating a home built before 1978. To find more information on lead-safe work practices or to find a Lead Safe Certified contractor, visit <http://www.health.state.mn.us/divs/eh/lead/homeowners/index.html>
- Pregnant and breastfeeding woman should be encouraged to follow CDC guidelines to ensure adequate calcium intake to minimize remobilization of calcium and lead from bone.<sup>1</sup>

# 4 [Identification of Lead Exposure]

## Blood Lead Testing

MDH recommends targeted blood lead screening of women who may be at risk for lead exposure. A risk assessment should be conducted at the first prenatal visit for each pregnant woman (Table 3), or if possible, during a pre-conception visit. The presence of a single risk factor should be sufficient rationale for conducting a blood lead test. Some health care providers who serve high-risk populations may choose to conduct blood lead testing on all pregnant women rather than administer the screening questionnaire. Because overt signs of lead exposure are often not present, a lack of clinical signs should not be used as a justification for not conducting a blood lead test.

**Table 3. Risk Screening Questionnaire for Pregnant Women**

Yes	No	Don't Know	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1. Do you or others in your household have an occupation that involves lead exposure?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2. Do you or others in your household have hobbies or activities likely to cause lead exposure?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3. During the last 12 months, did you move to Minnesota from another country or from a major metropolitan area?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4. Do you use any traditional folk remedies?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5. Do you live in a house built before 1978 that is currently being renovated?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6. Do you use handmade pottery, imported pottery, or leaded crystal?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7. Do you eat or chew on any nonfood items, such as clay, crushed pottery, soil, or paint chips?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8. Do you eat venison or other game that was harvested with lead bullets?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9. Do you have any bullets in your body from past gunshot wounds?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10. Were you ever diagnosed with lead poisoning in the past?
<p>Pregnant women who answer "Yes" or "Don't Know" to ANY of the above questions should have a blood lead test. Women should also be tested if they have any concerns about lead not addressed by this questionnaire.</p>			

## Methods for Blood Lead Test Collection and Analysis

Blood lead levels can be measured from either venous or capillary samples. Venous samples are more reliable and are the preferred sample type for blood lead testing in adults. Capillary samples can be a more convenient for screening for elevated blood lead levels, as samples can be tested on mobile units outside of a clinical setting. However, elevated blood lead test results detected from capillary samples should be confirmed with a venous sample.

Other methods for measuring lead in the body may be available, but are not recommended for clinical use. Measuring bone lead concentrations is generally limited to use during research. Lead can be measured in urine, but this method is generally limited to monitoring patients following chelation therapy. Lead tests on saliva and hair samples have also been marketed, but only limited data are available on how to interpret results from these samples. It should be noted that only blood lead tests have currently received FDA approval.

## Transmission of Blood Lead Test Results

The Minnesota state lead statute (MS 144.9502) requires that facilities performing blood lead analyses must report all results to MDH. The statute covers blood lead analyses performed at hospitals, clinics, laboratories, and other facilities on both capillary and venous specimens, and specifies epidemiologic information that must be reported, as well as time frames for reporting. This includes blood lead results for persons of all ages, regardless of whether or not the result was elevated.

Clinics with in-house blood lead analyzers must ensure that all blood lead test results are sent to MDH. Clinics that send samples for blood lead testing to reference laboratories do not need to report blood lead levels to MDH unless MDH requests additional information that was not transmitted from the laboratory. However, MDH does not receive pregnancy status of the patient with the blood lead test result. [Providers who have pregnant or breastfeeding patients with elevated blood lead test results should call the MDH Lead and Healthy Homes program at 651-201-4620 to expedite follow-up activities.](#)

## Methods to Reduce Elevated Blood Lead Levels in Pregnant Women

The most effective method for reducing lead exposure in pregnant women is to identify and eliminate the source of the exposure. Environmental assessments are conducted by MDH or local assessing agencies for all pregnant women with venous blood lead levels of at least 10 µg/dL. Environmental assessments can also be done for women with venous blood lead levels of 5–9 µg/dL if resources allow. Adequate calcium intake can minimize mobilization of calcium and lead stored in bones from historic exposures.

Chelation therapy in pregnant women should only be considered for very high blood lead levels. For more detail, see the section on chelation ([page 15](#)).

### YOU SHOULD KNOW

Providers who have pregnant or breastfeeding patients with elevated blood lead test results should call the MDH Lead and Healthy Homes program at 651-201-4620 to expedite follow-up activities.

## Nutritional Information

The best way to prevent elevated blood lead levels is by preventing exposure to lead. However, nutritional status can play a role in mitigating the absorption and physiological effects of lead. Key nutrients include calcium, iron, selenium, zinc, and vitamins C, D, and E. In addition, frequent regular meals may decrease absorption of lead from the gastrointestinal tract.

CDC recommends that pregnant or lactating women with current or historical blood lead levels  $\geq 5$   $\mu\text{g}/\text{dL}$  maintain a dietary intake of 2,000 mg of calcium daily.<sup>1</sup> This can be accomplished through diet or supplementation.

For other nutrients, there are no specific recommendations with respect to lead. General guidelines for nutrition during pregnancy and lactation should be followed. This includes identifying and correcting iron deficiency and providing nutritional consultation and prenatal vitamins as appropriate.

Several programs are available to help women and families meet their nutritional needs:

- Women who meet the income requirements may qualify for nutrition information and nutritious foods under the Women, Infants, and Children (WIC) Program. Program eligibility requirements and referral information can be found at <http://www.health.state.mn.us/wic/> or at 1-800-WIC-4030 (1-800-942-4030).
- Information on the food and assistance programs through the Minnesota Department of Human Services, including the Supplemental Nutrition Assistance Program (SNAP) and emergency food services can be found at <http://mn.gov/dhs/people-we-serve/children-and-families/economic-assistance/food-nutrition/programs-and-services/index.jsp>.
- The Minnesota Food Helpline is 1-888-711-1151



# 5 [Management of Lead Exposure]

## Blood Lead Level Actions

Recommended actions in response to blood lead level test results for pregnant women are listed in [Table 4](#). These are intended as guidelines; more frequent testing may be indicated based on the clinical course and risk factors of individual patients. Confirmatory and follow-up testing are more urgent with higher blood lead levels.

MDH does not receive pregnancy status of the patient with the blood lead test result. Providers who have pregnant or breastfeeding patients with elevated blood lead test results should call the MDH Lead and Healthy Homes program at [651-201-4620](tel:651-201-4620) to expedite follow-up activities.

Blood lead levels vary during pregnancy, even in the absence of interventions. Blood lead levels often decrease during 12–20 weeks gestation, and then increase again during late pregnancy.<sup>1</sup> Therefore, providers should conduct follow-up blood lead testing according to the guidelines in [Table 4](#) based on the patient's highest venous blood lead level during that pregnancy.

Women with occupational sources of exposure to lead can be referred to an occupational health specialist to discuss strategies and resources for reducing lead exposure in the workplace. Efforts should be made to reduce occupational exposure to lead even if blood lead levels do not rise to levels that would result in MNOSHA enforcement.

### YOU SHOULD KNOW

Blood lead levels vary during pregnancy. Providers should conduct follow-up blood lead testing based on the patient's highest venous blood lead level during that pregnancy.

Table 4. Blood Lead Level (BLL) Actions for Pregnant Women	
BLL (µg/dL)	Recommended Actions
<5	<ul style="list-style-type: none"> <li>• Provide information on sources of lead, how to prevent exposure, and nutrition information</li> </ul>
5–9	<ul style="list-style-type: none"> <li>• Provide counseling on possible sources of lead and information on how to reduce or eliminate exposure, including nutrition information</li> <li>• If result was from a capillary test, confirm with a venous test</li> <li>• Retest within 1 month. Obtain a maternal BLL or cord BLL at delivery</li> <li>• MDH will refer case to local public health agency for follow-up if pregnancy status is known to MDH</li> <li>• Assessing agencies (MDH or local public health) may conduct environmental assessments as resources allow if pregnancy status is known to MDH</li> </ul>
10–44	<ul style="list-style-type: none"> <li>• Provide counseling on possible sources of lead and information on how to reduce or eliminate exposure, including nutrition information</li> <li>• If result was from a capillary test, confirm with a venous test</li> <li>• Retest within 1 month and then every 1–3 months. Obtain a maternal BLL or cord BLL at delivery</li> <li>• MDH will refer case to local public health agency for follow-up if pregnancy status is known to MDH</li> <li>• Assessing agency (MDH or local public health) will conduct environmental assessment if pregnancy status is known to MDH</li> <li>• Patients with results <math>\geq 40\mu\text{g/dL}</math> are referred to MNOSHA by MDH</li> </ul>
$\geq 45$	<ul style="list-style-type: none"> <li>• Provide counseling on possible sources of lead and information on how to reduce or eliminate exposure, including nutrition information</li> <li>• If result was from a capillary test, confirm with a venous test</li> <li>• Retest within 24 hours. Consult with a lead poisoning expert to determine frequency of additional retesting. Obtain a maternal BLL or cord BLL at delivery</li> <li>• MDH will refer case to local public health agency for follow-up if pregnancy status is known to MDH</li> <li>• Assessing agency (MDH or local public health) will conduct environmental assessment if pregnancy status is known to MDH</li> <li>• Consider inpatient chelation in consultation with a lead poisoning expert</li> <li>• Patients are referred to MNOSHA by MDH</li> </ul>

## Management at Time of Delivery

If a baby is born to a mother who had an elevated blood lead level ( $\geq 5$   $\mu\text{g}/\text{dL}$ ) during pregnancy, umbilical cord blood should be tested to determine the newborn's blood lead level. The infant's pediatrician should be informed so that appropriate follow-up can take place, including early follow-up testing of the baby. Recommended schedules for follow-up testing based on the initial venous or umbilical cord blood result are presented in Table 5.

Table 5. Recommended timing of follow-up testing for infants based on initial venous or umbilical cord blood test results	
Initial BLL ( $\mu\text{g}/\text{dL}$ )	Timing of Initial Follow-Up Testing
<5	<ul style="list-style-type: none"> <li>At one year and two years of age if child has risk factors for lead exposure</li> </ul>
5–24	<ul style="list-style-type: none"> <li>Within 1 month</li> </ul>
25–44	<ul style="list-style-type: none"> <li>Within 2 weeks</li> <li>Consultation with a Pediatric Environmental Health Specialty Unit (PEHSU), medical toxicologist, or clinician experienced in managing elevated blood lead levels is recommended</li> </ul>
$\geq 45$	<ul style="list-style-type: none"> <li>Within 24 hours</li> <li>Consultation with a PEHSU, medical toxicologist, or clinician experienced in managing elevated blood lead levels is recommended</li> </ul>

## Chelation of Pregnant Women, Fetuses, and Newborn Infants

For most individuals with elevated blood lead levels, the primary means of reducing levels is by eliminating the source of the exposure. For pregnant women with very high blood lead levels ( $\geq 45$   $\mu\text{g}/\text{dL}$ ) or lead encephalopathy, chelation therapy may be considered in consultation with an expert in lead poisoning treatment.

The Great Lakes Center for Children's Environmental Health is a Pediatric Environmental Health Specialty Unit (PEHSU). Their team of health professionals is available for consultations on children's environmental health issues, including chelation therapy of pregnant women or infants. They can be reached toll-free at 1-866-967-7337 and more information can be found online: <http://www.uic.edu/sph/glakes/childrenshealth/>.

The Minnesota Poison Control System is also staffed by a team of medical toxicologists and other health care professionals who can also provide consultation for chelation therapy of pregnant women or infants. They can be reached toll-free 24 hours a day at [1-800-222-1222](tel:1-800-222-1222).

### Breastfeeding Recommendations for Women with Elevated Blood Lead Levels

Breastfeeding is the preferred infant feeding method, and conveys many benefits. For infants born to mothers with elevated blood lead levels, the benefits of breastfeeding should be weighed against the risk of transmission of lead through breast milk since lead has been shown to decrease IQ levels and alter neuropsychologic development, particularly in infants.<sup>2</sup> The ratio of lead in breast milk to lead in maternal blood is quite low; it is reported to be approximately 3%.<sup>1</sup> Because milk lead concentrations are typically low, breastfeeding will still be recommended in most circumstances, but requires monitoring of blood lead levels.

CDC recommends that women with blood lead levels  $<40$   $\mu\text{g}/\text{dL}$  initiate breastfeeding.<sup>1</sup> Women with blood lead levels  $\geq 40$   $\mu\text{g}/\text{dL}$  should postpone the initiation of breastfeeding; they should pump and discard their breast milk until their blood lead levels decrease below 40  $\mu\text{g}/\text{dL}$ .<sup>1</sup>

Infants born to mothers with elevated blood lead levels ( $\geq 5$   $\mu\text{g}/\text{dL}$ ) should be tested at birth and then monitored according to the schedule in [Table 5](#). Infants who maintain blood lead levels  $< 5$   $\mu\text{g}/\text{dL}$  should continue to be breastfed. Decisions about whether to continue breastfeeding infants with blood lead levels  $\geq 5$   $\mu\text{g}/\text{dL}$  should be made on a case-by-case basis, considering the mother's blood lead level, the trend of the infant's blood lead levels, and possible environmental sources of lead.

#### YOU SHOULD KNOW

CDC recommends that women with blood lead levels  $< 40$   $\mu\text{g}/\text{dL}$  initiate breastfeeding. Women with blood lead levels  $\geq 40$   $\mu\text{g}/\text{dL}$  should postpone the initiation of breastfeeding.

For infants who are fed reconstituted formula, steps should be taken to minimize the risk of introducing lead from water. Bottled water may be used. Municipal water supplies and private wells in Minnesota are not generally a substantial source of lead. However, plumbing systems may contain lead that can dissolve into the water. Letting cold water run for a minute or two before using water for reconstituting formula flushes dissolved lead out of the system. Only water from the cold tap should be used for infant formula.

## 6 [Selected Resources]

1. Centers for Disease Control and Prevention (CDC). Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women. Atlanta, GA: U.S. Department of Health and Human Services; 2010.
2. Hale, TW. Medications and Mothers' Milk, 16th edition. Amarillo, TX: Hale Publishing, L.P. 2014.
3. Centers for Disease Control and Prevention (CDC). Very high blood lead levels among adults - United States, 2002-2011. *Morb Mortal Wkly Rep.* 2013;62:967-71. Erratum in: *Morb Mortal Wkly Rep.* 2014;383:e3. *Morb Mortal Wkly Rep.* 2014;62:1053.
4. Bakhireva LN, Rowland AS, Young BN et al. Sources of Potential Lead Exposure among Pregnant Women in New Mexico. *Matern Child Health J.* 2013;17:172-179.
5. Jobs That May Have Lead Exposure. National Institute for Occupational Safety and Health (NIOSH). <http://www.cdc.gov/niosh/topics/lead/jobs.html>. Updated September 30, 2013. Accessed March 31, 2015.
6. Saper RB, Phillips RS, Sehgal A et al. Lead, Mercury, and Arsenic in US- and Indian-Manufactured Ayurvedic Medicines Sold via the Internet. *JAMA.* 2008;300: 915-923.
7. Lead Information for Hunters. Minnesota Department of Natural Resources. <http://www.dnr.state.mn.us/hunting/lead/index.html>. Accessed March 31, 2015.
8. CPG Sec. 545.450 Pottery (Ceramics); Import and Domestic — Lead Contamination. Food and Drug Administration (FDA). <http://www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm074516.htm>. Updated November 29, 2005. Accessed June 10, 2015.
9. Miranda ML, Edwards SE, Swamy GK, Paul CJ, and Neelon B. Blood Lead Levels Among Pregnant Women: Historical Versus Contemporaneous Exposures. *International Journal of Environmental Research and Public Health.* 2010; 7:1508-19.

### RESOURCES FOR PATIENTS

#### Occupational Health Concerns

MNOSHA Workplace Safety Consultation  
1-800-DIAL-DLI (1-800-342-5354)

#### Nutrition Information & Support

Woman, Infants, and Children Program  
(WIC)

1-800-WIC-4030 (1-800-942-4030)

Supplemental Nutrition Assistance Program  
(SNAP)

1-800-657-3698

Minnesota Food Helpline:  
1-888-711-1151

#### Questions about Chelation

Great Lakes Center for  
Children's Environmental Health:  
1-886-967-7337

Minnesota Poison Control:  
1-800-222-1222



Environmental Health Division  
Lead and Healthy Homes Program  
P.O. Box 64975  
St. Paul, MN 55164-0975