CHILDHOOD LEAD SCREENING

I. DEFINITION:

Lead is a naturally occurring metal found throughout the environment as a result of industrialization. Lead is toxic to humans at all levels. There is no safe level of lead and it serves no function in the human body. It is a poison that affects every system in the body. It is particularly harmful to the developing brain and nervous systems of fetuses and young children.

II. ETIOLOGY AND EPIDEMIOLOGY:

A. Lead poisoning is the number one environmental hazard for children and is one of the most common and preventable pediatric problems today. Primary prevention efforts should always be geared at eliminating the child’s exposure to lead. Educating the parents about lead-based paint, lead dust, and proper hand washing techniques should receive particular emphasis.

B. The rate and absorption of lead in children is dependent upon how the child is exposed to the lead and the physiological characteristics of the child (age & nutritional status). Children are most commonly exposed in low doses over an extended period of time. Children are most vulnerable to the effects of lead because they absorb a greater percentage of lead and because the young child’s brain and other organs are developing at such a rapid rate. Blood lead levels in children increase most rapidly at 6-12 months and peak at 18-24 months. Young children’s normal hand to mouth behavior puts them at particular risk. Children with poor nutritional status are more susceptible to lead poisoning and toxicity. The most commonly used index of absorbed lead is the blood lead level, measured in micrograms per deciliter (µg/dL) of blood.

C. Sources and Pathways

1. LEAD-BASED PAINT: This is the most common high-dose source of lead exposure for pre-school children. Children are exposed to lead when they ingest or inhale lead-based paint-contaminated dust or lead-based paint chips. About 83% of all homes built in the US before 1978 still contain lead-based paint. The older the house, the more likely it is to contain lead-based paint and to have a higher concentration of lead in the paint. Housing built before 1960 poses the greatest risk of exposure to children. About 24% of Oklahoma’s housing stock was built before 1960.

2. SOIL AND DUST: Children are exposed through ingestion or inhalation. Soil and dust act as pathways for lead that has been deposited by lead sources such as lead paint, leaded gasoline, and industrial or occupational sources. Scraping lead-based paint from old structures causes paint chips to fall onto and mix with the soil around the structure. Another source of paint chips being distributed, not only at the site but into neighboring areas, is “power washing” a house to remove flaking, loose paint. Since lead does not dissipate, biodegrade, or decay, the lead deposited into dust and soil becomes a long-term source of lead exposure for children.

3. OCCUPATION & HOBBIES: A variety of work and hobby environments exposes people to lead and may result in lead exposures to their families. Oil field workers, smelter or foundry workers, auto body repair, battery recycling, and building renovation or demolition are just a few of the approximately 120 different occupations that expose workers to lead. “Take Home” exposure may result when workers wear their work clothes home or launder them with the family laundry, or when they bring scrap material or industrial paint home from work.
(lead is still legal in industrial paint). Adults may unintentionally expose their children to lead dust from these occupations or hobbies when they have lead dust on their clothing and pick up the children or transfer the lead onto common surfaces such as couches, bedding, and floors, etc. Many hobbies may involve potentially hazardous levels of lead such as furniture refinishing and making stained glass. Other activities that may be associated with lead exposure include using indoor firing ranges, cleaning guns, doing home repairs and remodeling, and making fishing weights.

4. TRADITIONAL REMEDIES: Healers using a non-Western pharmacopoeia may manufacture products which contain lead. The products are then distributed to recent immigrant groups by friends and relatives or local healers. Examples of such products are Azarcón and Greta, containing 70-90% lead and used for stomach problems; Surma, applied to the eyelids of children to improve eyesight or as a teething powder; and Pay-loo-ah, used for rashes and fever. These products typically are imported from India, Mexico, and Southeast Asia. As immigrant populations increase and diversify, emerging sources of lead from traditional remedies, spices or cosmetic products are being identified as sources of lead exposure.

5. WATER: Lead levels are typically low in ground and surface water, but may increase once the water enters the water distribution system. Contamination of drinking water can occur at five points in or near the residential, school, public, or office plumbing, including:
   a) lead connectors;
   b) service lines or pipes;
   c) lead soldered joints in copper plumbing;
   d) water fountains and coolers; and
   e) lead containing brass faucets and other fixtures.

6. FOOD: Lead in foods comes from several sources.
   a) Soil in which the plant is grown;
   b) Food processing, (including lead leaching from some types of metal cans (imported);
   c) Imported foods or food wrappers that contain lead in the ink (especially candy wrappers on candy from Mexico);
   d) Improperly fired ceramic ware, leaded crystal; or
   e) Transfer of lead from environment onto food through poor food handling practices.

7. AIR: Lead use in gasoline has been markedly reduced. Previous use resulted in widespread contamination of soil and dust. Industrial activities may result in localized exposures to lead, including burning solid waste in incinerators and sandblasting or demolishing bridges and other lead-painted metal structures. Inhalation of airborne lead is a minor exposure pathway except around point sources such as smelters and battery manufacturing plants. Children who live near major highways or industrial areas where lead was a product or by-product are at higher risk for elevated lead levels.

8. TOYS, OBJECTS: Lead is sometimes used in the manufacture of items meant for children such as toys or jewelry found in vending machines or stores that carry inexpensive novelty items. Lead is inexpensive and durable and often unregulated in other countries. Many imported items contain unsafe amounts of lead either in the paint or within the plastic or metal components that make up the object. Young children commonly chew on or mouth items and could be exposed to lead in this fashion. Children with pica are at particular risk for eating items which could contain lead and are not intended for human consumption.
III. CLINICAL FEATURES: (effects of lead)

A. Signs & Symptoms

1. An individual with a low elevation of blood lead, (5-10 μg/dL) most likely will not exhibit signs & symptoms of lead toxicity. However, permanent damage to the child may occur with chronic exposures at low levels.

2. With increasing blood levels the following may be observed:
   
   a) Sleep disturbances
   b) Irritability/fussiness
   c) Anemia
   d) Abdominal pain
   e) Behavior problems
   f) Decreased intelligence
   g) Developmental delays
   h) Learning disabilities
   i) Impaired neurobehavioral development
   j) Decrease in stature or growth
   k) Decreased ability to maintain a steady posture
   l) Decreased hearing acuity
   m) Unexplained seizures
   n) Coma
   o) Death

B. Possible complications of severe, long term lead poisoning include:

1. Developmental delay
2. Seizures
3. Acute lead encephalopathy
4. Coma
5. Death

IV. MANAGEMENT PLAN:

A. Lead Exposure Risk Assessment Questionnaire (LERAQ)

Assessment refers to using the Lead Exposure Risk Assessment Questionnaire (LERAQ), ODH Form 386. If the child’s LERAQ has a “Yes” answer, the child is considered to be High Risk for lead exposure. If the child’s LERAQ has all “No” answers, the child is considered to be Low Risk for lead exposure.

1. Assess children for lead exposure risk using the LERAQ beginning at 6 months of age and yearly at appropriate clinic visits starting at 12 months of age and yearly thereafter up to 72 months of age.

2. The (LERAQ) ODH386 is used to document lead poisoning risk assessment and the need for blood lead screening with the exception at 12 months and 24 months of age when capillary blood lead testing is to be performed in coordination with the child’s primary care provider.
3. The LERAQ may be used at other times if the child has recently moved or if there is a concern (based on clinical features, reports from parent/guardian of signs and symptoms associated with high lead blood level or exposure to lead, and/or based on residence in an area known to have high lead levels from previous lead activities or a majority of older homes).

B. Blood Lead Screening (Capillary)

Screening refers to the collection of capillary blood to test the level of lead in the blood sample.

1. **Children are to have a capillary blood lead test (Universal Screening) at 12 months and 24 months of age in coordination with the child’s primary care provider.**

2. If a child is over 2 years of age and under 72 months of age and has never had a blood lead test, obtain a capillary blood lead test on the child when seen.

3. Health care providers may collect a venous blood lead test instead of a capillary blood lead test for blood lead screening.

4. If a child’s LERAQ has a “yes” answer a capillary blood lead test should be obtained.

5. If a child’s LERAQ from a previous visit had a “yes” answer but the resulting blood lead test was <5 µg/dL AND there have been no changes in the answers on the LERAQ, a blood lead test is not necessary.

6. When considering a blood lead test result for patient retest or follow-up, round any values reported with decimals to the nearest whole number (e.g., 4.5 rounded to 5 and 4.4 rounded to 4).

7. Capillary Blood lead results ≥10 µg/dL must be confirmed with a venous blood test. Initial capillary test results between 5 and 9 µg/dL may be confirmed with a second capillary test if it is obtained within 12 weeks. This second capillary test may be used only to confirm the initial elevated capillary result. Once a capillary result has been confirmed either via a second capillary test or with a venous test, all subsequent tests must be venous blood draws.

8. The higher the initial capillary blood lead test result, the more urgent the need for confirmatory blood testing.

9. **Always** use venous blood sampling when conducting follow-up of confirmed elevated blood lead levels (≥5 µg/dL).

10. Send capillary and venous blood samples to Tamarac Medical, Inc. for analysis. Contact Tamarac at 1-800-842-7069 for testing supplies and hand cleaning products.

11. For County Health Departments utilizing the LeadCare II, point of service blood lead testing device, ALL results must be submitted to OCLPPP using a Microsoft Excel template supplied by OCLPPP and reported electronically through a secure email website. See Electronic Reporting of LeadCare II results document.

C. Confirmatory Blood Lead Testing (Venous)
In order to be confirmed as an elevated blood lead level, the results of a capillary blood lead test above 10 µg/dL must be confirmed by a second blood draw obtained through venous testing. If the capillary result is between 5 and 9 µg/dL, a second blood draw may be obtained as a capillary sample for the purpose of confirming the result.

1. Once an elevated blood lead level is confirmed, the child is to be followed-up by retesting of venous blood. All additional or future blood lead testing must be collected as a venous blood specimen.

2. Refer to the confirmatory testing timeline listed in the Guidelines for Management of Blood Levels In Children- August 2017 (Appendix 1) for guidance on when to perform confirmatory blood testing.

D. Follow-up Testing

1. Follow-up venous blood lead testing is performed to determine if a venous blood lead level is decreasing or increasing.

2. Refer to the Guidelines for Management of Blood Lead Levels in Children – October 2017 (Appendix 1) as well as the Guidelines for Management of Blood Lead Levels in Children Algorithm (Appendix 2) for guidance management and blood lead testing.

E. Education

1. Educate parents about key sources of lead exposure and how to reduce exposure to lead.

2. Educate on diet high in iron and calcium. Children who have calcium deficiencies absorb greater amounts of lead. Children who have high lead levels may have problems with low iron levels.

3. Issue written lead educational material which may be obtained on the Oklahoma Childhood Lead Poisoning Prevention Program’s website: http://lpp.health.ok.gov.

4. Educational intervention must be modified if a child’s blood level continues to increase.

F. Consultation and Referral

1. Refer for medical evaluation as indicated by blood lead levels.

2. Refer to nutritional counseling if indicated by diet history.

3. The Oklahoma Childhood Lead Poisoning Prevention Program (OCLPPP) will notify and consult with local county health department personnel to arrange for an environmental investigation of the child’s home to determine the source of lead exposure. This occurs for children who have a confirmed (venous) blood lead level of 20 µg/dL or have had two tests (at least three months apart) with venous results of 15-19 µg/dL. The OCLPPP staff will arrange for a Certified Lead-Based Paint Risk Assessor/Inspector to conduct the Environmental Investigation in collaboration with the local health department and will provide the family with recommendations to remove the source of lead exposure for the child.

G. Prevention
1. Educate parents about childhood lead poisoning and how to reduce exposure to lead.

2. Work with appropriate groups in the public and private sectors to make sure that lead poisoned children receive appropriate medical, environmental, and social service follow-up.

3. Coordinate with health providers and others involved in lead-poisoning prevention activities.

H. Follow-up

1. Determine tracking priority utilizing professional judgment.

2. Notify family of screening appointments at appropriate ages as determined by risk category and blood lead level.

I. Patient outcome

1. Blood lead level will remain below 5 μg/dL.

REFERENCES:


Harvey, Birt, M.D., Editor, Centers for Disease Control and Prevention. Managing Elevated Blood Lead Levels Among Young Children; Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. March 2002.

Oklahoma Childhood Lead Poisoning Prevention Program
Lead Exposure Risk Assessment Questionnaire (LERAQ)

Child’s Name: ___________________________________________ Date of Birth: ________________

Date: ____________________ Age: _____________ Current Residential Zip Code: _______________

1. Does your child live in or regularly visit a house/building built prior to 1978 with peeling or chipping paint?  
   Note: This could include a day care center, preschool, relative’s home, etc.
   Yes   No

2. Does your child live in or regularly visit a house/building built prior to 1978 that has had remodeling or renovation in the past 6 months?  Yes   No

3. Does your child have friends, siblings, housemates, or a playmate that has been told they have lead poisoning or been treated for lead poisoning?  Yes   No

4. Does your child frequently put things in her/his mouth such as jewelry, keys, or toys? Have you been told your child has pica (eats non-food items)?  
   Note: This could include products that have been recalled by the Consumer Products Safety Commission due to unsafe lead levels.
   Yes   No

5. Has your family/child ever lived outside of the United States or recently arrived from a foreign country?  Yes   No

6. Does your child live with or come into frequent contact with an adult who has a job or hobby where lead is used?  
   Examples include: oil field worker, bridge painter, demolition or renovation of buildings, automobile work with batteries or radiators, lead solder, metal plating, furniture refinishing, leaded glass, lead shot or bullets and lead fishing sinkers.
   Yes   No

7. Does your family use products from other countries such as health remedies, some imported spices, or food, or store or serve food in leaded crystal, pottery, or pewter?  
   Note: Lead has been found in some traditional medicines such as Ayurvedic medicine, liga, greta, azarcón, litargirio, kohl, surma, and sindoor. Lead exposure risk is higher with old, imported, painted, cracked, or chipped china and pottery. These are often made in Latin America and the Middle East.
   Yes   No

If the answer to any of the above questions is YES, then the child is considered to be at risk for lead exposure and should receive a blood lead test.

• Ask any additional questions that may be specific to a particular community (or population) e.g., refugee child recently arrived in the United States, children with behavioral and/or developmental disabilities, families who mention moving to an older home, etc.
• Ask if any of the above conditions are expected to change in the future (e.g., house remodeling).
• Tailor appropriate education and information to the child and family.

Purpose: The LERAQ should be used to screen for possible risk of lead exposure in children 6 - 72 months of age except when the child receives routine blood lead testing at 12 and 24 months of age. Children found to be at risk for lead exposure should receive a blood lead test if such a risk is identified.

Use: This assessment may be administered by medical staff, or completed by the child’s parent or guardian.

Any "Yes" answer is considered a positive answer, thus requires the child to have a blood lead test.

Routing and Filing: Retain this record in the child’s record to review annually.

<table>
<thead>
<tr>
<th>Age</th>
<th>Blood Test</th>
<th>LERAQ</th>
<th>(Provide Education and Prevention Information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Months</td>
<td>See LERAQ responses</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9 Months</td>
<td>See LERAQ responses</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12 Months</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>24 Months</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>36 to 72 Months</td>
<td>X (if no record of previous blood lead test at 12 or 24 months)</td>
<td>X (Unless obtaining blood lead test)</td>
<td>X – If LERAQ is administered</td>
</tr>
</tbody>
</table>

Oklahoma Childhood Lead Poisoning Prevention Program  
Screening and Special Services  
Oklahoma State Department of Health  
1000 NE 10th Street

Telephone: (405) 271-6617  
Toll Free: 1-800-766-2223  
Email: oklppp@health.ok.gov

OSDH Form #386-Rev 10/2017
CAPILLARY BLOOD LEAD LEVELS

<table>
<thead>
<tr>
<th>Blood Lead (µg/dL)</th>
<th>Significance</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>Not Elevated</td>
<td>Risk assessment (LERAQ) at well-child visit or clinic visit. No additional action is necessary unless an exposure risk change has occurred.</td>
</tr>
<tr>
<td>≥ 5</td>
<td>Needs Confirmation</td>
<td>Confirm results with a venous specimen. A second capillary may be used if venous not available for results for 5 - 9 µg/dL only.</td>
</tr>
</tbody>
</table>

CONFIRMATORY TESTING TIMELINE

If capillary (screening) blood lead level (µg/dL) is: Perform venous (diagnostic) confirmatory blood test:

<table>
<thead>
<tr>
<th>Blood Lead (µg/dL)</th>
<th>Significance</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 14</td>
<td>Elevated</td>
<td>Retest with a venous test every 3 months until trend is downward or stable and then less often as trend indicates. Provide family with lead education including nutritional and environmental interventions.</td>
</tr>
<tr>
<td>15 – 19</td>
<td>Moderate Elevation</td>
<td>Retest with a venous test every 1 – 3 months until trend is downward or stable and then less often as trend indicates. If blood lead level remains between 15 – 19 µg/dL after 2 venous tests at least 30 days apart, proceed according to actions for 20 – 44 µg/dL range.</td>
</tr>
<tr>
<td>20 – 44</td>
<td>High Elevation</td>
<td>Environmental Investigation should be initiated. Refer for medical management. Child needs a venous blood draw every 1 – 2 months until trend is downward or stable and then less often as trend indicates. Pharmacological treatment may be indicated. Contact OCLPPP to arrange an environmental investigation.</td>
</tr>
<tr>
<td>45 – 69</td>
<td>Severe Elevation</td>
<td>Children in this range need both medical and environmental intervention. Refer for medical management. Child needs a venous blood draw every 2 weeks – 1 month (or more frequently if status requires) until trend is downward or stable and then less often as trend indicates. Pharmacological treatment may be indicated.</td>
</tr>
<tr>
<td>≥ 70</td>
<td>Emergency</td>
<td>Children in this range need immediate medical treatment and environmental intervention. Child needs a venous blood draw every 2 weeks – 1 month (or more frequently if status requires) until trend is downward or stable and then less often as trend indicates.</td>
</tr>
</tbody>
</table>

For more information or additional copies of this form contact Screening and Special Services and ask for information on Lead Poisoning at 405-271-6617 or toll free 1-800-766-2223 or email OKLPP@health.ok.gov.

*If a retest time range is given, county health department nurses will retest based on the shorter retest time interval.
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Guidelines for Management of Blood Lead Levels in Children – October 2017
Oklahoma State Department of Health Childhood Lead Screening

Capillary Blood Lead

< 5 μg/dL
Not Elevated
Risk assessment (LERAQ) at well-child visit. No additional action is necessary unless an exposure risk change has occurred.

5 - 9 μg/dL
Needs Confirmation
Additional testing needed within 3 months:
A second capillary test may be obtained if it is collected within 12 weeks of the first capillary test.

--OR--
Confirm results with a venous specimen.

> 10 μg/dL
Needs Confirmation
Confirm results with a venous specimen.

If capillary result is:
- > 5 – 14 μg/dL: collect venous specimen within 3 months.
- 15 – 19 μg/dL: collect venous specimen within 1 month.
- > 20 μg/dL: collect venous specimen within 1 week.

Venous Blood Lead

< 5 μg/dL
Not Elevated
Risk assessment (LERAQ) at next well-child visit. No additional action is necessary unless an exposure risk change has occurred.

5 - 14 μg/dL
Elevated
Rescreen with a venous test every 3 months. Provide family with lead education including nutritional and environmental interventions.

15 - 19 μg/dL
Moderate Elevation
Rescreen with a venous test every month. If blood lead level remains between 15 – 19 μg/dL after 2 venous samples at least 30 days apart, proceed according to actions for 20 – 44 μg/dL range.

20 - 44 μg/dL
High Elevation
Environmental investigation should be initiated. Refer for medical management. Child needs a venous blood draw every month. Pharmacological treatment may be indicated. Contact OCLPPP to arrange an environmental investigation.

45 - 69 μg/dL
Severe Elevation
Both medical and environmental intervention required. Refer for medical management. Child needs a venous blood draw every 2 weeks. Pharmacological treatment may be indicated.

> 70 μg/dL
EMERGENCY
Children in this range need immediate medical treatment and environmental evaluation. Child needs a venous blood draw every 2 weeks.

Venous Specimen Collection

Please be advised that all results are rounded up or down as appropriate per CDC guidelines. (Example: 4.7 μg/dL would be recorded as 5 μg/dL, and 4.2 μg/dL would be recorded as 4 μg/dL for follow-up and surveillance). For more information or additional copies of this form, contact Screening and Special Services and ask for information on Lead Poisoning at 405-271-6617 or toll free at 1-800-766-2233 or email OKLPPP@health.ok.gov.