



Requirements and
Recommendations



Clinical Risk
Assessment and
Testing Methodology



Follow-Up Schedule
and Education

NC Childhood Lead Testing and Follow-Up Manual



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**NC Department of Health and Human Services • Division of Public Health •
Environmental Health Section • Childhood Lead Poisoning Prevention Program**

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North Carolina
Minimum Recommendations for Lead Poisoning Prevention
Effective Date: October 1, 1999
Revised Date: September 5, 2019

Distribution of Educational Materials

Educational materials regarding lead exposure should be made available to families of all children less than 72 months of age. Distribution of these materials should occur during all well-child visits. Educational materials are available on the web at <https://nchealthyhomes.com/lead-poisoning/> or by calling the NC Childhood Lead Poisoning Prevention Program (NC CLPPP) at (919) 707-5950.

Assessment for Risk of Exposure

Lead poisoning remains a principle environmental concern for young children, universal blood lead testing at 12 months and again at 24 months of age (or at first contact between 25 and 72 months if the child has not been previously tested) is strongly encouraged.

Immigrant children: Testing for all immigrant children should be conducted at the time of arrival to the United States. Internationally adopted children and refugee children are considered high risk as they may be malnourished. Malnourished children may be at increased risk, especially those deficient in iron, calcium and/or zinc. All refugee children 6 months to 16 years of age to the United States should be tested at the time of arrival and again after 3-6 months.

Coordinated Approach to Testing

Note: Local health departments should take the initiative to assure a coordinated approach to the universal blood lead testing of young children participating in Health Check (Medicaid), N.C. Health Choice, or WIC as well as refugee children. All primary care providers should be included in this process.

At a minimum, for children who are not required to be tested, the "EHS 3958: Lead Risk Assessment Questionnaire" should be administered on all children at 12 months and 24 months of age or at first contact between 25 and 72 months if the child has not been previously assessed or does not meet the above criteria. The questionnaire protocol determines those children who should receive blood lead testing at those ages. Questionnaires are available at <http://ehs.ncpublichealth.info/forms.htm> or by calling the NC CLPPP at (919) 707-5950.

Blood lead testing and risk assessment (when indicated) should occur during well-child visits to the child's primary care provider. Referral solely for risk assessment or blood lead testing is strongly discouraged.

Testing Methodology

Direct blood lead measurement is the screening test of choice. Finger stick, capillary blood specimens are adequate for initial testing and follow-up testing provided proper washing of the child's hands with soap and water before the finger stick to minimize the risk of contamination from lead residue on skin. Venous blood specimens should be collected for confirmation of all initial blood lead test results $\geq 5\mu\text{g/dL}$; however, capillary tests are accepted if a venous cannot be obtained.

Please note: As of July 1, 2017, clinical and environmental follow-up is according to the **truncated blood lead levels** rather than rounded, due to the legal interpretation of the NC General Statute § 130A-131.7. **Definitions.** This means that a test result of ≥ 4.0 but $< 5.0\mu\text{g/dL}$ should be truncated to $4\mu\text{g/dL}$ and should be followed-up according to the guidelines for test results $< 5\mu\text{g/dL}$. Numbers after the decimal place will not be considered in follow-up.

The State Laboratory of Public Health (State Lab) offers analysis of blood specimens for all children less than six years of age, refugee children 16 years of age or younger, and pregnant women receiving prenatal care at local health departments in North Carolina at no charge to the Medicaid or N.C. Health Choice (NCHC) beneficiary. Providers are encouraged to use the State Lab as this expedites test result reporting.

Point-of-Care (POC) Blood Lead Analyzers

The Clinical Laboratory Improvements Amendments (CLIA) designates facilities that use POC blood lead analyzers (e.g., LeadCare[®] II) as laboratories. As such, they are required to report all blood lead test results for children less than six years old to the NC CLPPP even if determined in a clinical setting, per NC General Statute § 130A-131.8. **Laboratory reports.** Use of POC blood lead analyzers are NOT acceptable for analyzing diagnostic (i.e., confirmation) blood lead specimens.

Medical and Environmental Response to Test Results

An outline of medical and environmental responses to test results can be found in the **Quick Reference Section** or for more detail, **Chapter 4 (Diagnostic Lead Testing and Management of Children with Elevated Blood Lead Levels)**. This outline is not intended to replace professional judgment, which must be based on the blood lead level, the presence of symptoms and other circumstances particular to an individual child in question.

Reference and background information can be found on the Lead Publications website of the Centers for Disease Control (<https://www.cdc.gov/nceh/lead/publications/default.htm>).

QUICK REFERENCE GUIDE

Diagnostic Testing Schedule

Initial Test Result ($\mu\text{g}/\text{dL}$)	Perform Diagnostic Test on Venous Blood Within:
5-9	3 months
10-19	1 month
20-44	1 week
45-59	48 hours
60-68	24 hours
≥ 70	Immediately, as an emergency lab test

FAQs about the 3651 Form (Exposure History of Child with Elevated Blood Lead Level)

How do I get the form? You can copy the form located in the Appendix of this manual or print it from the Children's Environmental Health's website at the address below.

<http://ehs.ncpublichealth.info/forms.htm>

When do I complete the form? The form should be completed when a child returns for a diagnostic (i.e., confirmation) test.

How is the form used? The form is used to take a child's environmental history, document blood lead test results and to identify and educate the family about sources of lead exposure.

The form may also be used to refer a child for environmental follow-up by sending a copy to Environmental Health at the local health department. All children who meet the legal definition as having an Elevated Blood Lead Level (EBL) or Confirmed Lead Poisoning (CLP) per G.S. § 130A-131.7 should be referred for environmental follow-up. Contact information for local environmental health specialists can be found at the link below.

<https://ehs.ncpublichealth.info/docs/EHS-DirectoryFEB2019.pdf>

Where do I send the form? If the diagnostic test result confirms that the child has a blood lead level $\geq 5\mu\text{g}/\text{dL}$, completed forms may be sent via fax to (919) 841-4015 or mail to Children's Environmental Health; NC DHHS, Division of Public Health; 1934 Mail Service Center; Raleigh NC 27699-1934. *NC LEAD users may also scan and attach the completed 3651 form to the Child Event in the NC LEAD surveillance system.*

If the child meets the legal definition as having an EBL or CLP, a copy of the form should be sent to Environmental Health at the local health department to refer the child for environmental follow-up.

Still have questions? Please call the Childhood Lead Poisoning Prevention Program directly at (888)774-0071 or the Environmental Health main number at (888) 251-5543 and ask to speak to someone from the Childhood Lead Poisoning Prevention Program.

QUICK REFERENCE GUIDE

FAQs about Childhood Lead Poisoning Surveillance Reports

What is the purpose of the Surveillance Report? To let you know that these children have at least one blood lead test result ≥ 5 $\mu\text{g/dL}$ and need diagnostic (i.e., confirmation) or follow-up testing and to assure that NC CLPPP has received all blood lead test results for each child. The report also lists children who should be referred to Environmental Health at the local health department for environmental follow-up.

How do I get a Surveillance Report? NC LEAD users can print a surveillance report by clicking the “Reports” icon after logging into the NC LEAD system. If you do not have access to NC LEAD, you can request a surveillance report via email LeadHelpDesk@lists.ncmail.net or phone toll free at (888) 774-0071 or (888) 251-5543 and ask to speak to someone in the Childhood Lead Poisoning Prevention Program.

What do I do with this report? When you get a report please check the spelling of names and dates of birth information for children listed on this report. Records are matched by name and date of birth to produce this and other reports. If there is an error, blood lead records for children may be missing. If a test result is missing from the report, please fax a copy of the missing laboratory report to our secure fax number at (919) 841-4015.

Do I need to send laboratory reports for a child who is retested? According to state law, laboratories are required to electronically report all blood lead test results for children electronically. Health care facilities that use point of care (POC) blood lead analyzers (e.g., LeadCare II) are also considered laboratories and are responsible for electronically reporting blood lead test results to NC CLPPP.

Acceptable electronic file formats are any spreadsheet or database format including .xls, .xml, and .accdb. Please contact Tena Hand at (919) 707-5933 to set up secure electronic reporting for your POC laboratory. If you send blood samples to an outside laboratory for analysis, the laboratory should directly report these results to NC CLPPP.

However, if you notice a test result missing from the surveillance report, please fax a copy of the missing laboratory report to (919) 841-4015 or mail it to NC DHHS, Division of Public Health; Children’s Environmental Health; 1934 Mail Service Center; Raleigh NC 27699-1934.

Why are children listed who have moved or been reported as lost to follow-up? It is not unusual for a child who has moved to return to the state. Likewise, a child reported as lost to follow-up sometimes turns up again. By continuing to list these children on the report, it serves as a reminder that should they show up in the system again, they are still in need of clinical follow-up. If the child shows up in another county or is tested at another clinic, the child’s information will move off the report and show up on the other county/clinic surveillance report. If you have notified NC CLPPP that a child has moved or is lost to follow-up, this information should be listed on the report under Additional Comments.

How do I get a child listed as lost to follow-up? It is recommended that a certified letter be sent to the child's last known address to document efforts to bring the child back in for follow-up. You may also try contacting the family's local health department, Social Services or the WIC Program to see if they can provide additional information. If these efforts fail to get the child back in for follow-up services, you can notify the NC CLPPP that the child is lost to follow-up via phone (888)-774-0071, fax (919) 841-4015 or mail NC DHHS, Division of Public Health; Children's Environmental Health; 1934 Mail Service Center; Raleigh NC 27699-1934.

Still have questions? Call the Childhood Lead Poisoning Prevention Program directly at (888)-774-0071 or call Environmental Health at (888) 251-5543 and ask to speak to someone in the Childhood Lead Poisoning Prevention Program.

Chapter 1

Introduction

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Chapter 1: INTRODUCTION

Background

Childhood lead poisoning is one of the most common environmentally-caused pediatric health problems in the United States today. The persistence of lead poisoning—in light of present knowledge about the sources, pathways and prevention of lead exposure—continues to present a direct challenge to clinicians and public health authorities. According to the U.S. Centers for Disease Control and Prevention (CDC), there are approximately half a million U.S. children ages 1-5 with blood lead levels above 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$), the reference value at which CDC recommends public health actions be initiated.

Lead Reference Value

In 2012, the CDC established a level of **5 $\mu\text{g}/\text{dL}$** as the reference value at which public health interventions are initiated. This value is based on the 97.5th percentile of the blood lead distribution among children 1–5 years old in the United States using data generated by the National Health and Nutrition Examination Survey (NHANES). The reference value will be re-evaluated by CDC every four years based on the most recent data.

Lead has no known physiological value, and no safe level of lead has been identified. Children are particularly susceptible to its toxic effects. Although lead poisoning can affect nearly every system in the body, lead is especially toxic to the developing brains of young children. At low levels of exposure, lead can cause learning disabilities, lowered IQ, attention deficit disorders and anti-social behavior. However, most poisoned children have no apparent symptoms, and as a result, many cases go undiagnosed and untreated. At very high levels ($\geq 70\mu\text{g}/\text{dL}$), lead exposure is an acute condition and can have devastating health consequences, including encephalopathy, seizures, coma and death. Blood lead testing is encouraged as an important element of a comprehensive program to eliminate childhood lead poisoning. The goal of such testing is to identify children who need individual interventions to reduce their exposure.



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The major source of lead exposure among U.S. children is deteriorated lead-based paint and lead-contaminated dust. Other sources of lead poisoning are contaminated drinking water; parental occupations with lead exposure; older vinyl mini-blinds; imported spices, candies, and home health remedies; and certain parental hobbies (listed on p.3). Although lead-based paint was banned for use in residential housing in 1978, an estimated 4 million homes continue to expose children to lead hazards. Children living in older, deteriorating housing and/or living in poverty are at higher risk for lead exposure. In North Carolina, deteriorating housing stock in rural areas may contribute to disproportionately higher percentages of children with blood lead levels $\geq 10\mu\text{g}/\text{dL}$ in rural compared to urban counties.

However, no socioeconomic group, geographic area, racial or ethnic population is spared the effects of lead poisoning.

Ideally, *all* children would be offered blood lead testing when they are 1 and 2 years old. The risk of lead poisoning is highest at age 2, yet fewer children are tested at this age. Your clinic may choose to provide universal blood lead testing for all 1 and 2-year-olds at well-child or other visits. Our task as public health officials, as health care providers and as parents is to identify children who will most benefit from testing and ensure that they receive the necessary services. Blood lead testing at 1 and 2 years of age is **required** for children enrolled in Health Check (Medicaid), Health Choice and/ or the Special Nutrition Program for Women, Infants and Children (WIC Program). Detailed testing recommendations are covered in Chapter 2 of this manual.

Sources and pathways of lead exposure in children

Lead primarily enters the body via ingestion or inhalation. Lead poisoning prevention best practices for the general public are to avoid the common sources of exposure listed below, to practice regular handwashing with soap and water to remove lead residue from the skin, and to eat a balanced diet rich in iron, calcium and vitamin C to slow lead absorption into the body.

Lead-based paint. A common source of high-dose lead exposure to young children is deteriorated paint found in older homes. Lead paint is most commonly found in pre-1950 homes but may be found in any home built before 1978.

Soil and house dust. Lead-contaminated dust from deteriorated paint is common on floors, porches, doorways and windows sills and troughs of pre-1978 homes. Soil containing lead may be found near the foundations of old homes and near major roads due to leaded gasoline. Lead dust released into the air by certain industries may also settle in the soil.



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Vinyl miniblinds. Miniblinds manufactured prior to 1996 may contain lead as a stabilizing agent. Exposure to ultra-violet light deteriorates the vinyl, causing lead-contaminated dust to accumulate on the surface of the blinds. Old miniblinds should be replaced with lead-free, cord-free window coverings in child-occupied homes.

Drinking water. Lead pipes or copper plumbing connected with lead solder may contaminate water. A change in the water treatment process may trigger leaching of lead into the public water supply.

Food. Some imported canned foods and spices contain lead, as do foods served from leaded crystal or



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ceramic dishes with lead-containing glaze. Some types of fish and products made from fish may also contain lead and mercury.

Air. Emissions from lead smelters and other lead-related industries may be sources of lead contamination.

Parental occupations and hobbies. People who work with lead may bring home lead-contaminated dust on their shoes, cell phones, eye glasses, keys, clothing, or vehicles. Workers in occupations such as battery manufacturing and recycling, car painting and repair, building painting and renovation, nonferrous smelting, radiator repair, brass and bronze foundries, locksmiths, pottery production, training on firing ranges, and demolition/maintenance of outdoor metal structures are more likely to have occupational lead exposure. Hobbies such as reloading or casting ammunition, renovating homes or furniture, or making stained glass, pottery, fishing weights and jewelry are common sources of lead exposure.

Pottery. Homemade and imported pottery may contain large amounts of lead in the glaze. Lead can leach out of this type of pottery if it is used to serve or store food, especially acidic foods. Traditional pottery used in cooking may poison entire families. Look for pottery labeled “lead-free” when purchasing new cookware.

Medicines. Immigrant families often use traditional medicines and folk remedies. Ayurvedic medicines have been implicated in both child and adult lead poisoning cases. Azarcon (also known as Rueda, Coral, Maria Luisa, Alarcon or Liga) and Greta are remedies imported from Mexico that contain 90 to 100 percent lead by weight. Any amount of these products is poisonous to children and adults. Azarcon is a bright orange powder; Greta is a yellow powder. Both are used to treat “Empacho” (intestinal illness). Children who are given these powders are ingesting lead, and they may develop the same symptoms that these medicines are intended to treat. Paylooah is a red powder that contains high levels of lead. Paylooah is used by the Hmong people to treat rash or fever. Lead has also been found in some Chinese herbal medications such as Ba-Baw-San. An FDA alert for lead content was issued for an Ayurvedic medicine called Balguti Kesaria after the product was tested in North Carolina in 2017 as part of the environmental investigation for a child with an elevated blood lead level.

Cosmetics. Another source of lead may be eye cosmetics called Surma, Kajal or Kohl, which are used by some Indian, African and Middle Eastern immigrants. Lead has been found in aphrodisiacs imported from India and Africa, and in sindoor, a Hindu religious powder and cosmetic.

See the chart at the end of this chapter for other medications and cosmetics found to contain lead.

Toys. Imported and antique toys and collectibles may put children at risk for lead exposure. Lead may be used in two aspects of toy manufacturing: paints or plastics. To reduce these risks, the U.S. Consumer Product Safety Commission (CPSC) issues recalls of toys that could potentially expose



children to lead. Look for children's products that meet American Society for Testing and Materials (ASTM) or other international safety certification. Photos and descriptions of recalled toys can be found at <http://www.cpsc.gov> or call 1-800-638-2772 (TTY 800-638-8270).

Candy. Lead has been found in some candies imported from Mexico. Certain candy ingredients such as chili powder and tamarind may be a source of lead exposure. Lead sometimes gets into the candy when processes such as drying, storing, and grinding the ingredients are done improperly. Also, lead has been found in the ink printed on wrappers of some imported candies. People selling these candies may not know whether the candy contains lead. You cannot tell by looking or tasting if candy contains lead, so blood lead testing is recommended to determine exposure. More information and advisories on lead in candy and other foods can be obtained from the FDA at www.fda.gov or 1-888-463-6332.

Keys. Brass keys and metal key chains often contain lead. Do not allow children to teethe or suck on house or car keys or other objects not intended for young children.

Visit the lead sources image library at <https://nchealthyhomes.com/lead-sources/> to view photographs of items that have been found to contain lead.

STAFF ROLES

Prevention of and follow-up for childhood lead poisoning is a multidisciplinary effort requiring teamwork. Effective teams may include members with expertise in nursing, medicine, social work, nutrition, child development and environmental health.

TRAINING OFFERED

Workshops offered by the NC Childhood Lead Poisoning Prevention Program (CLPPP) are open to all health care providers, and cover topics such as:

- ◆ Basic Information about lead
- ◆ Health effects from lead exposure
- ◆ Blood lead testing
- ◆ Case management for children with elevated lead levels
- ◆ Environmental remediation of lead hazards

For more information, contact the NC CLPPP office at 919-707-5950 or 888-774-0071.

The UNC Center for Environmental Health and Susceptibility also offers an online training module “Preventing Lead Poisoning: A Module for Health and Housing Professionals,” available at https://nciph.sph.unc.edu/tws/HEP_CEHS1/certificate.php.

MORE BACKGROUND INFORMATION

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Alternative Cosmetics, Food Additives, and Medicines that Contain Lead

Exposure Source	Description/Exposure Pathway
<i>Albayalde</i> or <i>albayaldle</i>	Used mainly by Mexicans and Central Americans to treat vomiting, colic, apathy and lethargy.
<i>Al Kohl</i> (Middle East, India, Pakistan, some parts of Africa)	A gray or black eye cosmetic applied to the conjunctival margins of the eyes for medicinal and cosmetic reasons. Can contain up to 83% lead. It is believed to strengthen and protect the eyes against disease and may be used as an umbilical stump remedy. Also known as simply as kohl .
<i>Al Murrah</i>	Used as a remedy for colic, stomach aches and diarrhea in Saudi Arabia.
<i>Anzroot</i>	A remedy from the Middle East used to treat gastroenteritis.
<i>Azarcon</i>	Also known as alarcon , coral , luiga , maria luisa , or rueda . Bright orange powder used to treat "empacho" (an illness believed to be caused by something stuck in the gastrointestinal tract, resulting in diarrhea and vomiting). Azarcon is 95% lead.
Ayurvedic medicine (Tibet)	Traditional medicines that may contain lead. Some examples include: guglu , sundari kalp , jambrulin
<i>Ba-Baw-San</i> or <i>Ba-Bow-Sen</i> (China)	Herbal medicine used to detoxify "fetal poisoning" and treat colic pain or to pacify young children.
<i>Bali goli</i>	A round, flat black bean which is dissolved in "gripe water" and used within Asian Indian cultures for stomach ache.
<i>Balguti Kesaria</i>	An Ayurvedic medicine from India used to treat rickets, cough and cold, worms and teething.
<i>Bint Al Zahab</i> (Iran)	Rock ground into a powder and mixed with honey and butter given to newborn babies for colic and early passage of meconium after birth.
<i>Bint Dahab</i> (Saudi Arabia; means "daughter of gold")	A yellow lead oxide used by local jewelers and as a home remedy for diarrhea, colic, constipation and general neonatal uses.
<i>Bokhoor</i> (Kuwait)	A traditional practice of burning wood and lead sulfide to produce pleasant fumes to calm infants.
<i>Cebagin</i>	Used in the Middle East as a teething powder.
<i>Chuihong tokuwan</i>	A pill imported from Hong Kong used to treat a wide variety of ailments.
<i>Cordyceps</i>	Used in China as a treatment for hypertension, diabetes and bleeding.
<i>Deshi Dewa</i>	A fertility pill used in Asia and India.
<i>Farouk</i>	A teething powder from Saudi Arabia.
<i>Ghasard</i>	Brown powder used in Asian Indian cultures as a tonic to aid in digestion.
<i>Greta</i> (Mexico)	Yellow powder used to treat "empacho" (see azarcon); can be obtained through pottery suppliers, as it is also used as a glaze for low-fired ceramics. Greta is 97% lead.
<i>Hai Ge Fen</i> (<i>Concha cyclinae sinensis</i>)	A Chinese herbal remedy derived from crushed clam shells.
<i>Henna</i>	Used as a hair dye and for temporary tattoos in the Middle East and India - may contain lead.

Items in **RED** were added by the NC Childhood Lead Poisoning Prevention Program.

Modified from CDC Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women, pg 194-195. Original document posted at: <http://www.cdc.gov/nceh/lead/publications/LeadandPregnancy2010.pdf>

<i>Jin Bu Huan (China)</i>	An herbal medicine used to relieve pain.
<i>Kandu</i>	A red powder from Asia and India used to treat stomach ache.
<i>Koo Sar</i>	Red pills from China used to treat menstrual cramps.
<i>Kushta</i>	Used for diseases of the heart, brain, liver, and stomach and as an aphrodisiac and tonic in India and Pakistan.
<i>Litargirio</i>	A yellow or peach-colored powder used as a deodorant, a foot fungicide and a treatment for burns and wound healing particularly by people from the Dominican Republic.
<i>Lozeena</i>	An orange powder used to color rice and meat that contains 7.8%-8.9% lead.
<i>Mojhat ceremonial drink</i>	Egyptian tea used as lactation aid.
<i>Pay-loo-ah (Vietnam)</i>	A red powder given to children to cure fever or rash.
<i>Po Ying Tan (China)</i>	An herbal medicine used to treat minor ailments in children.
<i>Saffron supplement</i>	Red threads (stigmas) from a flower used as a spice, food coloring, and herbal supplement to treat respiratory ailments, depression, and menstrual problems. Can be found in orange-yellow capsule form for use as a supplement.
<i>Santrinj (Saudi Arabia)</i>	An amorphous red powder containing 98% lead oxide used principally as a primer for paint for metallic surfaces, but also as a home remedy for "gum boils" and "teething."
<i>Surma (India); Kohl; Kajal</i>	Black powder used as an eye cosmetic and as teething powder or umbilical stump remedy.
<i>Tibetan herbal vitamin</i>	Used to strengthen the brain.
<i>Traditional Saudi medicine</i>	Orange powder prescribed by a traditional medicine practitioner for teething; also has an antidiarrheal effect.

Items in **RED** were added by the NC Childhood Lead Poisoning Prevention Program.
Modified from CDC Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women, pg 194-195.
Original document posted at: <http://www.cdc.gov/nceh/lead/publications/LeadandPregnancy2010.pdf>

Chapter 2

Lead Testing Requirements and Recommendations

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Chapter 2: Lead Testing Requirements and Recommendations

Key Points

- A blood lead test at ages 12 and 24 months is recommended for all NC children. This is required for children with Medicaid.
- Children with elevated blood lead levels should be re-tested according to the clinical follow-up schedule.
- Refugee children 6 months to 16 years should be tested at entry into the U.S. *and* 3-6 months after placement.
- Lead testing consists of an initial capillary sample (can be done with point-of-care analyzers) followed by a diagnostic (preferably venous) sample. If the parent or guardian refuses the venous draw, wash the child's hands well with soap and water to get a more accurate capillary sample. All diagnostic samples must be sent to an outside reference laboratory for analysis, regardless of sample type.
- Offices using POC analyzers are considered laboratories and are required by law to report blood lead results for children < age 6 years to NC CLPPP.

General Population

It is recommended that all children have a blood lead test **at 12 and 24 months** of age at the clinic where they receive well child care (e.g., private, health department, community health center) Blood lead specimens should be collected by the child's primary care provider at well child visits or at other visits if not done at the well child check.

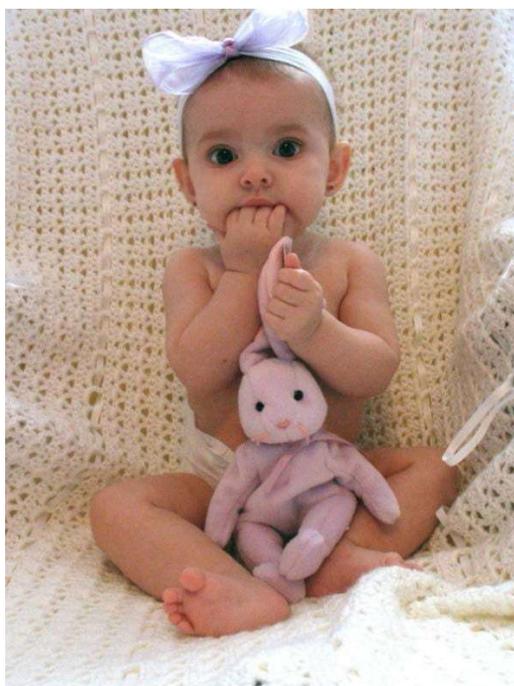
Children under six years of age who first enter the health care system between 25 and 72 months of age should have a lead screening test at their first visit if no record of prior lead testing is available. Although it is preferred that the assessment occurs at 12 and 24 months of age, there are acceptable ranges of ages during which screening may occur. For the 12-month screening, the acceptable range is from 9 through 18 months of age. For the 24-month screening, the acceptable range is from 18 through 30 months of age, with the goal being to conduct the screening as close as possible to 24 months of age.

Children identified as high risk for ongoing lead exposure (e.g., from a parental job or hobby that involves lead exposure or an unmitigated lead hazard in the child's environment) may warrant more frequent testing. Children with an initial abnormal test result should be retested as indicated by their blood lead level result (see **Follow up Schedule**).

Childhood lead poisoning peaks at two years of age, yet fewer children in North Carolina are tested at this age than at one year of age. Two-year-olds are at higher risk of lead poisoning than one year olds due to the increased mobility and curiosity of toddlers at this age. Research has shown little value to screenings done prior to one year of age, due to children's developmental stages with respect to mobility and hand-to-mouth behaviors. However, testing before 1 year of age may be appropriate for children who are more mobile or at risk of high lead exposure due to parental occupation or other risk factors.

Healthcare providers are encouraged to conduct a blood lead test on *all* children at 12 months and again at 24 months of age (universal screening). If universal screening is not practiced at your clinic, conduct risk-based screening at 12 months *and* 24 months of age to determine testing using **Form 3958: Lead Risk Assessment Questionnaire** [available in **Appendix D**]. Page 2 of the form lists zip codes in North Carolina that data has shown have a higher risk of lead poisoning for children. If the child lives in one of the high-risk zip code areas listed, they should be tested for lead, regardless of the answers on the risk assessment questionnaire. If the child lives in a low-risk zip code and all the answers on the risk assessment questionnaire are "No", the child is to be reassessed at 24 months of age. Any "Yes" or "I don't know" response on the questionnaire indicates the need to do a blood lead test. Children living in housing built before 1978 and children living in older homes undergoing renovation are at particular risk.

Special Populations at Higher Risk for Lead Poisoning



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Medicaid, Health Choice, and Women, Infants and Children (WIC) Program Participants

All children enrolled in Health Check (Medicaid), Health Choice or the Special Nutrition Program for Women, Infants and Children (WIC Program) are **required** to have a blood lead test at 12 and 24 months of age. Children between 25-72 months must be tested if they have not previously been tested.

When children present for a WIC certification between 12 and 36 months old, WIC staff are to assess whether blood lead testing was performed by the child's health care provider. If the lead test was not done or if the test result is not available, a blood lead test should be performed only when children are having a hemoglobin or hematocrit test done at the local agency during the WIC certification visit. Otherwise, the child should be referred to the agency's lead program staff or to the child's medical home, depending on the agency's

protocol. To avoid unnecessarily testing a child twice in one year, WIC staff should ask the parents to notify their child's medical home that a lead test was already performed.

Refugee Children and Immigrants

The prevalence of elevated blood lead levels among newly resettled refugee children is higher than that for US-born children. This is attributed to several possible factors: (1) exposures in their previous country of residence; (2) malnutrition, particularly deficiencies in iron, calcium and zinc; (3) living and playing in high-risk areas in the US, such as in and around homes built before 1978; and (4) exposure to lead-containing foods, candies, ceramics, utensils, cosmetics, ceremonial powders, and traditional remedies.

CDC recommends that all refugee children **6 months to 16 years of age** are to be tested at the time of arrival to the United States. Blood lead testing should be repeated 3 to 6 months after placement in a permanent residence **regardless of initial test results for children 6 months to 6 years old**. See **'Refugee Children' Appendix G** for more details. Repeat testing has revealed elevated blood lead levels in some refugee children even when initial test results were not elevated. Chronic malnutrition and pica, which is common among certain refugee populations, put some of these children at greater risk of lead poisoning *after* placement in permanent residences. Therefore, this repeat blood test is considered to be a "medical necessity."

Refugee children **younger than 6 years of age** should also undergo nutritional assessments. Iron deficiency should be corrected. Calcium and zinc deficiencies may also increase the risk of lead poisoning. Consider daily pediatric multivitamins with iron for refugee children 6 months to 6 years of age and WIC referral if eligible. See **'Refugee Children' Appendix G** for more details.

In New Hampshire in 2000, a two-year old girl died of cerebral edema due to lead poisoning. She was from Sudan; the family had come to the U.S. as refugees after living in Egypt. The child had iron deficiency with anemia and observed pica. An environmental investigation traced the source of lead to deteriorated paint and plaster in the family's U.S. apartment which was built in the 1920's. This sad case illustrates the need to test refugee children for lead poisoning after placement as well as at entry. *[CDC. Fatal Pediatric Lead Poisoning—New Hampshire, 2000. MMWR 2001;50: 457-9]*

The testing recommendations for refugee children also apply to immigrant children and children of immigrant parents from less developed countries. They, like refugees, are at increased risk for lead poisoning by having lived in or traveled to their country of origin or by living in sub-standard housing in the United States.

International Adoptees

The CDC recommends that all internationally adopted children have a blood lead test during their first medical examination in the U.S. *and* at 12 and 24 months of age.

Evidence suggests that a significant proportion of immigrant and adopted children have elevated blood lead levels. Risk of elevated blood lead levels varies by country of origin.

Indications for Additional Testing

Blood lead testing should be done at times other than the routine testing schedule if it is suspected that a child faces increased risk for lead exposure. Indications for additional testing include:

- ✓ **Increased likelihood of exposure due to housing.** A child's risk for lead exposure may increase because *the family has moved* to older housing or to a geographic area with a higher prevalence of lead poisoning or older housing, or because the child lives in an older home that has recently been repaired, remodeled or renovated. High risk zip codes in North Carolina are listed on the back of the **Form 3958: Lead Risk Assessment Questionnaire [Appendix D]**.
- ✓ **Parental request.** Parents may express concern about their children's potential lead exposure because of residence in older housing, nearby construction or renovation, an elevated blood lead level (EBL) in a neighbor's child, or other possible exposures. Such information may be valuable in highlighting potential exposure. A blood lead test should be performed if there is any reason to suspect that lead exposure has occurred.
- ✓ **Parental occupation or hobby.** If a child's parent is exposed to lead at work, they may inadvertently bring home lead dust, thus exposing the child. There are lead producing industries in North Carolina and children have been lead poisoned due to parental take-home exposures. Also, hobbies such as bullet making, target shooting, and stained-glass making can expose children to lead. See **Chapter 1** for more occupations and hobbies that can create a lead exposure risk.

Testing Methodology

Capillary blood lead samples are adequate for the initial blood lead test. Venous blood lead samples are strongly recommended for confirmation of all blood lead test results $\geq 5\mu\text{g}/\text{dL}$. [See the **Quick Reference Guide** for the diagnostic testing schedule based on the initial blood lead test result.]

The Centers for Disease Control and Prevention (CDC) now has an updated video demonstrating the best procedures for capillary sampling, entitled "Mission Unleaded: How to test children for lead with maximum accuracy," which can be found at:

<https://www.youtube.com/watch?v=g2p2qREch9g>

Please note: Blood lead test results should be truncated to the whole number when determining the type of referrals to make and timing of follow-up. For example, test results between 4.1 to 4.9µg/dL are truncated to 4µg/dL, not rounded. Truncating these values allows for comparability with results reported from other laboratories and for submission to the National Lead Surveillance System at the Centers for Disease Control and Prevention.

Report all blood lead test results to parents/guardians and document notification. Reporting blood lead test results not only informs the parent of the child's blood lead status but also facilitates prevention and education. Parental notification may also stimulate questions and feedback from the parent to the medical provider as to what the parent/guardian understands about the potential health effects of lead and how lead exposure may affect their child. It also provides the parent with the knowledge to seek further testing options and measures to prevent future lead exposure. Educational materials are available online at <http://nchealthyhomes.com/lead-poisoning/> or by calling (919) 966-2463.

Laboratory Analysis of Blood Lead Levels

State Laboratory of Public Health

The State Laboratory of Public Health will analyze blood lead specimens for all children less than six years of age (and refugee children through age 16 years) at no charge. Providers requesting analysis of specimens from children outside of this age group will need to contact the State Laboratory of Public Health at 919-807-8878 *before sending a specimen* to provide a justification for sending it and receive further instructions.

State Laboratory test results feed directly into the NC Division of Public Health's blood lead surveillance system, NCLEAD, removing the need for burdensome data entry by providers.

The Medicaid program encourages all providers to utilize the State Laboratory of Public Health for blood lead tests on children (under 6 years of age) because it will:

- ◆ Expedite reporting of blood lead test results for Medicaid recipients
- ◆ Contribute to the creation of a central database on blood lead testing
- ◆ Help assess the extent of North Carolina's lead problem
- ◆ Save money for the Medicaid program

Point-Of-Care (POC) Blood Lead Analyzers

A growing number of health care providers in North Carolina are using point-of-care (POC) blood lead analyzers to test children for lead poisoning. Use of these analyzers provides an immediate test result, which reduces delays in obtaining diagnostic (i.e., confirmatory) samples to confirm elevated initial results. The diagnostic **venous** sample can be drawn immediately and sent to an outside laboratory for analysis, thereby

removing the difficulty of bringing the patient back for the venous blood draw on a separate day. In May of 2017, the U.S. Food and Drug Administration (FDA) warned that the current POC analyzer on the market should not be used to analyze **venous** samples due to inaccurate results. Use of this POC lead analyzer for capillary (fingerstick) samples is still approved.

<https://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm558733.htm>

The Clinical Laboratory Improvement Amendments (CLIA) designates facilities that use a POC lead analyzer as laboratories.

Did you know? All clinics that use a POC analyzer for lead testing are **required** to report all blood lead test results for children less than six years old residing in North Carolina to the North Carolina Childhood Lead Poisoning Prevention Program (NC CLPPP).

To arrange for reporting blood lead test results, please contact Tena Hand at 919-707-5933 (tena.hand@dhhs.nc.gov) or Melanie Napier at 919-707-5861 (melanie.napier@dhhs.nc.gov).

NC CLPPP requires that all diagnostic test specimens be analyzed at a reference laboratory (State Laboratory or another laboratory that uses a high complexity analysis method). Test results obtained using the POC lead analyzer cannot be accepted as a diagnostic result.

Required data for Reporting

There is a legal requirement in North Carolina that blood lead test results for children under six years of age should be reported with the following demographic data:

- child's full name,
- date of birth,
- primary street address,
- city and zip code,
- sex,
- race,
- ethnicity
- Medicaid number (if any).



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For full details of required laboratory reporting, see **Table 1: North Carolina General Statutes**.

TABLE 1: North Carolina General Statutes *revised July 2017*

§ 130A-131.7. Definitions.

- (3) "Confirmed lead poisoning" means a blood lead concentration of 10 micrograms per deciliter or greater determined by the lower of two consecutive blood tests within a 12-month period.

- (5) "Elevated blood lead level" means a blood lead concentration of 5 micrograms per deciliter or greater determined by the lower of two consecutive blood tests within a 12-month period.

§ 130A-131.8. Laboratory Reports of blood levels in children.

(a) All laboratories doing business in this State shall report to the Department all environmental lead test results and blood lead test results for children less than six years of age and for individuals whose ages are unknown at the time of testing. Reports shall be made by electronic submission within five working days after test completion.

(b) Reports of blood lead test results shall contain all of the following:

- (1) The child's full name, date of birth, sex, race, ethnicity, address, and Medicaid number, if any;
- (2) The name, address, and telephone number of the requesting health care provider;
- (3) The name, address, and telephone number of the testing laboratory;
- (4) The laboratory results, whether the specimen type is venous or capillary; the laboratory sample number, and the dates the sample was collected and analyzed.

§ 130A-131.9A. Investigation to identify lead poisoning hazards.

(a) When the Department learns of confirmed lead poisoning, the Department shall conduct an investigation to identify the lead poisoning hazards to children and pregnant women. The Department shall investigate the residential housing unit where the child or pregnant woman with confirmed lead poisoning resides. The Department shall also investigate the supplemental addresses of the child or pregnant woman who has confirmed lead poisoning.

(a1) When the Department learns of an elevated blood lead level, the Department shall, upon informed consent, investigate the residential housing unit where the child or pregnant woman with the elevated blood level resides. When consent to investigate is denied, the child or pregnant woman with the elevated blood lead level cannot be located, or the child's parent or guardian fails to respond, the Department shall document the denial of consent, inability to locate, or failure to respond.

§ 130A-131.9C. Abatement and Remediation.

(a) Upon determination that a child less than six years of age or a pregnant woman has a confirmed lead poisoning of 10 micrograms per deciliter or greater and that child or pregnant woman resides in a residential housing unit containing lead poisoning hazards, the Department shall require remediation of the lead poisoning hazards. The Department shall also require remediation of the lead poisoning hazards identified at the supplemental addresses of a child less than six years of age or a pregnant woman with a confirmed lead poisoning of 10 micrograms per deciliter or greater.

Chapter 3

State Laboratory Procedures

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Chapter 3: State Laboratory Procedures

Key Points

- The State Laboratory performs blood lead analysis free of charge for children under 6 years, refugee children 16 years or younger, and pregnant women receiving prenatal care at local health departments in North Carolina.
- The State Laboratory will not process blood lead specimens collected on patients who are not residents of North Carolina.
- NCSLPH provides special mailers for collection and shipment of samples and specimens. The mailers must be ordered through their Online Supply Ordering System.
- Hand-washing is an essential first-step to collection of capillary samples. Alcohol wipes alone will not remove lead residue from the child's hands, so skipping the handwashing step may yield an artificially elevated blood lead test result.
- Immediate shipping of specimens is recommended to ensure specimen integrity and suitability for analysis. If not shipped immediately, store in refrigerator. NCSLPH must receive the specimen within 28 days of collection.

About Blood Lead

Childhood lead poisoning is a major, preventable environmental health problem. The persistence of lead poisoning, in light of present knowledge about the sources, pathways and prevention of lead exposure, continues to present a direct challenge to clinicians and public health authorities. As a result of industrialization, lead is common in the environment. Lead has no known physiological value and children are particularly susceptible to its toxic effects. Most poisoned children have no apparent symptoms, and consequently, many cases go undiagnosed and untreated. Lead poisoning is widespread and is not solely a problem of poor, inner city or minority children. No socioeconomic group, geographic area, racial or ethnic population is spared its effects.

Blood lead testing is encouraged as an important element of a comprehensive program to eliminate childhood lead poisoning. The goal of such testing is to identify children who need individual interventions to reduce their exposure.

No safe level of lead in a child's body has been identified. At higher levels (≥ 70 $\mu\text{g}/\text{dL}$), lead exposure is an acute condition and can have devastating health consequences, including encephalopathy, seizures, coma and even death. New data indicate adverse effects of lead exposure in children at blood lead levels previously believed to be safe. As a result, in 2012, the Centers for Disease Control (CDC) intervention level of 10 $\mu\text{g}/\text{dL}$ was lowered to the reference value of 5 $\mu\text{g}/\text{dL}$.

The North Carolina State Laboratory of Public Health (NCSLPH) performs blood lead analysis free of charge for the following groups:

- children under the age of 6 years,
- refugee children age 16 years or younger, and
- women receiving prenatal care at local health departments in North Carolina (details below).

The NCSLPH now performs prenatal lead testing in partnership with local public health departments in North Carolina. Prenatal care patients seen in clinics that meet the required criteria assessed using the **Lead and Pregnancy Risk Questionnaire** (DHHS 4116 E/S, found at https://nchealthyhomes.com/files/2014/04/Lead-and-Pregnancy-Risk-Questionnaire_Updated-10_2015.pdf) will be eligible for this testing. *Please be advised that the required specimen type for adult lead testing is a venipuncture specimen (rather than fingerstick) collected in a lavender-top blood collection tube.* The specimen must be accompanied by a completed **Form DHHS 3707** (link provided below) and the “prenatal” box must be checked appropriately.

Since the Centers for Disease Control and Prevention does not recommend blood lead testing of *all* pregnant women in the United States, state or local public health departments should identify populations at increased risk for lead exposure and provide community specific risk factors to guide clinicians in determining the need for blood lead testing. **Routine blood lead testing of pregnant women is only recommended in clinical settings that serve populations with specific risk factors for lead exposure.** Health care providers serving lower risk communities should consider the possibility of lead exposure in individual pregnant women by evaluating risk factors for exposure as part of a comprehensive occupational, environmental, and lifestyle health risk assessment of the pregnant woman, and perform blood lead testing if a single risk factor is identified.

The newest methodologies to detect lead present in blood at lower levels include Inductively Coupled Plasma Mass Spectrometry (ICP/MS). In addition, a multi-tier approach to follow-up has been adopted with an overall goal of reducing blood lead levels.

Attention:

The North Carolina State Laboratory of Public Health will not process blood lead specimens collected on patients who are not residents of North Carolina.

If any serious elevations were detected, the North Carolina Childhood Lead Poisoning Prevention Program would not have any jurisdiction in another state.

Ordering Supplies

The NCSLPH furnishes, at cost, mailers for collection and shipment of samples and specimens. These mailers are carefully selected by the Laboratory to meet U.S. Postal Service/DOT diagnostic specimen shipping and packaging regulations to minimize problems such as leakage or breakage, and to identify the type of specimen or sample through color coding. Color coding speeds up the process of sorting and routing thousands of specimens and samples received daily. The mailers are provided for shipping specimens or samples only to the State Lab.

The NCSLPH Online Supply Ordering System **must be used to order supplies**. You can access supplies by going to this website:
[https://slphreporting.ncpublichealth.com/labportal/\(S\(u0o4zrncgjitnvm5uil4y03fg\)\)/LoginForm.aspx](https://slphreporting.ncpublichealth.com/labportal/(S(u0o4zrncgjitnvm5uil4y03fg))/LoginForm.aspx)

You must have an account to access the system. To set up a new account please call (919)733-7656 or follow the instructions for setting up a new account on the website.

Specimen Identification, Collection and Shipment

A. DHHS form #3707

Blood Lead Analysis Form and specimen collection device kit are available from The NCSLPH website at: <https://slph.ncpublichealth.com/Forms/3707-BloodLead-201609.pdf>

It is imperative that **all** of the following information be given:

- Patient information: Last name, first name, physical address, city, state, county code and zip code
- Patient number or social security number
- Date of birth
- Medicaid number, if applicable
- Race, ethnicity and sex
- Patient status: child, refugee, prenatal and/or WIC
- Specimen Data: collection date, initial or follow-up test, microtainer or venous
- Submitter name and/or tax identification number (EIN)
- NPI number and Provider name

Blood Lead CPT Code: 83655
ICD-10 Code: Z 13.88 [Encounter screen for disorder due to exposure to contaminants]

Tips on filling out Form 3707 Completely

1. Use Social Security and Medicaid numbers.
2. County should be coded as child's county of residence, not the county in which the specimen was obtained.
3. Print or type information clearly.
4. Place labeled microtainer in a plastic bag, keeping **Form 3707** separate from specimen. Place sample and **Form 3707** into approved mailing container. Do not mail in envelopes or other mailing devices.
5. Send specimen to NCSLPH as soon as possible. If transport is delayed, refrigerate specimen. Specimen **MUST BE RECEIVED** by the NCSLPH within four weeks (28 calendar days) from date of collection.

B. Preparation for Collection of Finger Stick Blood Sample

1. To remove lead residue from the skin, wash child's hands thoroughly with soap and water. Rinse well. Dry.
2. Grasp the child's hand so that the thumb of the blood drawer is across the top of the child's fingers.
3. Hold the child's hand so that the palm faces up.
4. Use child's middle or ring finger for sample collection.
5. Using an alcohol wipe, briskly scrub the child's fingertip for 20 seconds.



Note that alcohol wipes alone will not remove lead residue from the child's hands, so skipping the handwashing step (#1) may yield an artificially elevated blood lead test result.

6. Using dry gauze, wipe scrubbed area once.
7. Use lancet to stick finger slightly left of center.
8. Use dry gauze to wipe off the first drop of blood.
9. After specimen collection, care of puncture site should be consistent with your institution's procedures.

C. Collection of Blood Sample

1. Continuing to grasp the finger, touch the tip of the capillary of collection device to the beaded drop of blood. Capillary must be held continuously in a horizontal position during specimen collection to prevent air bubbles from forming in the capillary tube.
2. After 3-4 drops of blood fall from the full capillary into the microtainer, you should have enough blood (150-250µg/L).
3. Turn capillary/tube unit immediately to a vertical position to allow the blood in the capillary to flow into the tube.
4. Remove capillary with holder at the same time. Close microtainer with attached cap.
5. Agitate the specimen to mix the anticoagulant through the blood.
6. Properly label with patient's first and last name. Place in a refrigerator until specimen is shipped.

D. Shipment

The NCSLPH must receive the specimen within 28 days of collection; however, immediate shipping is recommended to ensure specimen integrity and suitability for analysis. If not shipped immediately, store in refrigerator.

Place the specimen in a plastic bag with separate pouch for requisition. Place return address label on outside of container. Packaging and shipping instructions are available from the NCSLPH website at:

<https://slph.ncpublichealth.com/Forms/InstructionsforBloodLeadShipment-050317.pdf>

Receiving Results of Blood Lead Tests

Specimens are usually analyzed and reported on the day received by the NCSLPH.

Online results are available from the NCSLPH website at:

https://celr.ncpublichealth.com/index;jsessionid=uK-lab_hz6UgPvWJizFqVy5L33tKsVRELf7ReXUn.localhost

Patient results for Blood Lead Testing will be accompanied by Reference Value Ranges provided by the CDC. Please note that the Provider of record and the North Carolina Childhood Lead Poisoning Prevention Program (NCCLPPP) or Adult Blood Lead Epidemiology and Surveillance (ABLES) program will be immediately notified (i.e., via telephone) of abnormally high results ($\geq 25\mu\text{g/dL}$) and a hardcopy final report will be issued; all other results will be reported via hardcopy to the Provider of record.

Results are reported in micrograms per deciliter ($\mu\text{g}/\text{dL}$) of whole blood. The range of results reported is $<1\mu\text{g}/\text{dL}$ to $>100\mu\text{g}/\text{dL}$. Requisition forms are retained by the NCSLPH for two years plus the current year and are filed according to laboratory accession number. Occasionally, results are given as one of several "Unsatisfactory Specimen Codes." These require submission of another specimen for analysis.

For more information, about the North Carolina State Laboratory of Public Health, download *SCOPE: A Guide to Laboratory Services* at:

<https://slph.ncpublichealth.com/doc/SCOPE-090618-v2.pdf>

Please call for any questions or concerns:

Kate Koehler

Hemachemistry Manager

919-807-8878

Chapter 4

Diagnostic Lead Testing and Management of Children with Elevated Blood Lead Levels

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Chapter 4: Diagnostic Lead Testing and Management of Children with Elevated Blood Lead Levels

Key Points

- When a child has an elevated initial *capillary* blood lead level, *venous* blood should be drawn for diagnostic (confirmatory) testing.
- Capillary samples can also be used for follow-up testing unless the test result puts a child in a new, higher-risk category. If it does, conduct a new diagnostic test to confirm the higher risk category.
- Diagnostic tests must be sent to an outside reference laboratory.
- Clinical and environmental action taken in response to elevated blood lead levels depends on the blood level. Consult the **Follow-up Schedule for Diagnostic/Confirmed Blood Lead Levels for Children** for information on when to conduct diagnostic testing, follow-up testing, and the actions recommended for each.
- Send **Form EHS 3651: Exposure History of Child with Elevated Blood Lead Level** to NC CLPPP *after diagnostic testing has confirmed the elevated blood lead level*. Do not send the 3651 Form before you have the diagnostic test result or if the diagnostic test result is $< 5 \mu\text{g/dL}$. The form can be faxed, a copy mailed, or uploaded into NCLEAD, the NC lead surveillance system.



Chapter 2 of this manual discussed initial blood lead testing of children in the general population and those in higher-risk groups. This chapter will address the medical and environmental actions that are recommended when a child is found to have an elevated blood lead (EBL) level of ≥ 5 $\mu\text{g}/\text{dL}$ on an initial test.

Diagnostic (Confirmatory) Venous Testing

Children with confirmed lead poisoning can be asymptomatic. The risk for adverse health effects should be based on the child's blood lead level, not on the presence or absence of symptoms. A capillary sample is usually used for the initial (screening) blood lead test. When a child has an elevated *capillary* blood lead level, *venous* blood should be drawn for confirmatory testing. A second capillary test may be used for the diagnostic sample if a parent or guardian refuses venipuncture; however, be sure to wash the patient's hands with soap and water before taking the capillary sample to reduce the possibility of contamination.

Both venous and capillary confirmatory samples should be submitted to outside reference laboratories for analysis. The urgency of confirmatory venous testing depends on the child's risk based on the initial test result. Confirmatory venous testing should be conducted according to the schedule listed below (**Table 1**).

TABLE 1. DIAGNOSTIC TESTING SCHEDULE

Initial Test Result ($\mu\text{g}/\text{dL}$)	Perform diagnostic test on venous blood <i>within</i> :
5-9	3 months
10-19	1 month
20-44	1 week
45-59	48 hours
60-69	24 hours
≥ 70	Immediately, as an emergency lab test.

Laboratory Testing

Point-of-care blood lead analyzers should never be used with venous samples—the results can be inaccurate. All diagnostic samples should be sent to a reference laboratory, regardless of whether they are venous or capillary. The NC State Laboratory of Public Health will analyze blood lead samples from children under age 6 free of charge. Always report blood lead test results to parents, help them to understand the results, and provide educational materials on sources of lead and adverse health effects in children (see **Appendix E**).

Required Information

As discussed in Chapter 2, North Carolina public health law (**§130A-131.8**) requires that the following patient demographic data be submitted with all blood lead tests submitted for children younger than six years of age:

- Full name
- Date of birth
- Complete address including zip code (for primary residence)
- Race
- Ethnicity
- Medicaid # (if applicable).

This information is required for samples analyzed using a point-of-care lead analyzer as well as for samples sent to a reference laboratory. *Why is this data required?* The data is used for public health surveillance to monitor childhood lead exposure in North Carolina and target lead poisoning prevention interventions. Analysis of surveillance data can identify high-risk geographic areas and assess whether race, ethnicity and socioeconomic status affect a child's risk of lead exposure. For the most recent surveillance data see <https://ehs.ncpublichealth.com/hhccehb/cehu/lead/data.htm>.

Complete data is also critical for the case management and medical and public health follow-up of children with elevated lead levels. For example, an environmental health home lead investigation cannot be conducted if the child's address is unknown. Health care providers and laboratory staff should ensure that the address and other required information is submitted with each blood lead test ordered.



Follow-up based on confirmatory venous test results

The follow-up schedule for blood lead testing is explained in **Table 2. North Carolina Division of Public Health Follow-up Schedule for Diagnostic/ Confirmed Blood Lead Levels for Children under the Age of Six** (shown on the following page and **Appendix J**). This table shows actions to take based on the child's blood lead level.

Providers may use capillary blood lead tests for follow-up testing, unless the child's test result puts him in a new risk category, which would require a new diagnostic test to be performed. For example, if a child was confirmed at the 10-19µg/dL level, but the follow-up test done a month later has a result of 20µg/dL, that child will need a venous test for confirmation at the 20-44µg/dL level.

**TABLE 2. NORTH CAROLINA DIVISION OF PUBLIC HEALTH
FOLLOW-UP SCHEDULE FOR DIAGNOSTIC / CONFIRMED BLOOD LEAD LEVELS
FOR CHILDREN UNDER THE AGE OF SIX**

Blood Lead Level	Response
<p align="center">Clinical and environmental follow-up is based on the <i>truncated</i> test result. Example: Actual result= 4.79; Actions based on truncated value= 4</p>	
<p>All diagnostic (i.e., confirmation) tests should be performed as soon as possible within specified time periods.</p> <ul style="list-style-type: none"> ➤ <u>Diagnostic tests</u> should be venous; however, capillary tests are accepted if a venous cannot be obtained. ➤ <u>Follow-up testing</u> can be capillary. ➤ CDC protocol for capillary sampling of blood lead should be followed. (See Resources) ➤ If diagnostic test result falls into a lower category - follow response for the lower risk category. ➤ If diagnostic or follow-up test result falls into a higher category – conduct <u>another</u> diagnostic test to confirm the higher risk category. Follow guidelines for higher risk category, after confirmation. ➤ Point of care (POC) lead analyzers (i.e., LeadCare) should NOT be used for diagnostic tests. ➤ Diagnostic tests must be sent to an outside reference laboratory. 	
<p align="center"><5 µg/dL</p>	<ul style="list-style-type: none"> • Report blood lead test result to parents and document notification • Educate family about lead sources and prevention of lead exposure <p align="center">Retest at age 2, earlier if risk of exposure increases</p>
<p align="center">5-9 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 3 months)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 5-9 µg/dL:</p> <ul style="list-style-type: none"> • Provide clinical management • Conduct nutritional assessment and refer child to the WIC Program • Take environmental history to identify lead sources (DHHS 3651 Form) • Refer to local health department to offer an environmental investigation • Test other children under the age of six in same household <p>Follow-up testing: Every 3 months until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)</p>
<p align="center">10-44 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 1 month at 10-19 µg/dL; within 1 week at 20-44 µg/dL)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 10-44 µg/dL:</p> <ul style="list-style-type: none"> • Refer to local health department for required environmental investigation and remediation enforcement if hazards are identified • Refer child to CDSA* Early Intervention or CC4C** as appropriate • Refer to Social Services as needed for housing or additional assistance <p>Follow-up testing:</p> <ul style="list-style-type: none"> • 10-24 µg/dL: every 1-3 months until 2 consecutive tests are <5 µg/dL • 25-44 µg/dL: every 2 weeks to 1 month until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)
<p align="center">45-69 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 48 hours at 45-59 µg/dL; 24 hours at 60-69 µg/dL)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 45-69 µg/dL:</p> <ul style="list-style-type: none"> • Consult with Carolinas Poison Center (1-800-222-1222) for advice on chelation and/or hospitalization • Consider an abdominal x-ray check for an ingested object • Alert NC CLPPP by calling 919-707-5950 <p>Follow-up testing: 45-69 µg/dL: every 2 weeks to 1 month until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)</p>
<p align="center">≥70 µg/dL</p> <p align="center"><i>(Perform emergency diagnostic test immediately)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is ≥70 µg/dL:</p> <ul style="list-style-type: none"> • Hospitalize child and begin medical treatment <u>immediately</u> <p>Follow-up testing: Same as 45-69 µg/dL category</p>

*Children's Developmental Service Agency

**Care Coordination for Children

Updated 6/20/2018

Resources:

- [DHHS 3651 Form](#)
- [Agencies for Referrals by County](#)
- [Educational Materials for Families](#)
- [CDC Protocol for Capillary Sampling of Blood Lead](#)
- [CDC Protocol for Later Follow-up Testing after Blood Lead Level \(BLL\) Declining](#)



Evaluating possible sources of lead exposure of a child with an elevated blood lead level

Public health form **EHS 3651: Exposure History of Child with Elevated Blood Lead Level** should be used by the health care provider to assist in the determination of potential sources of lead exposure for a child with a confirmed blood lead level ≥ 5 $\mu\text{g}/\text{dL}$ and to educate the family about lead poisoning prevention (see **Appendix D**; also at <http://ehs.ncpublichealth.com/docs/forms/cehu/DHHS3651EvalChildWithEBLRev030916FINAL.pdf>).

Explain to parents why these questions are necessary and how they may relate to their child's blood lead levels.

This form should be completed when the child comes in for the confirmatory test (preferably venous). Send **Form EHS 3651** to NC CLPPP *after diagnostic testing has confirmed the elevated blood lead level*. **Form EHS 3651** can be faxed to (919) 841- 4015 or a copy mailed to NC CLPPP, 1934 Mail Service Center, Raleigh NC 27699- 1937. *NCLEAD users may scan and attach the 3651 form to the Child Event in the NCLEAD System. Do not send the 3651 Form before you have the diagnostic test result or if the diagnostic test result is < 5 $\mu\text{g}/\text{dL}$.*

Form EHS 3651 is also used as a referral form to Environmental Health for a Lead Investigation.

For a child with a confirmed elevated blood lead level (≥ 5 -9 $\mu\text{g}/\text{dL}$):

2. Fill in the entire form and check all answers.
3. Obtain the name and address of the owner of the child's primary residence.
4. Retain the original copy of the form at the local health department or provider's office with the child's medical record. Fax a copy of the form to the address listed above.
5. A home lead evaluation by an environmental health specialist will be offered for all children under six years of age with a blood lead level of 5-9 $\mu\text{g}/\text{dL}$.

For a child with confirmed lead poisoning (≥ 10 $\mu\text{g}/\text{dL}$):

1. Fill in the entire form and check all answers.
2. Obtain the name and address of the owner of the child's primary residence.
3. Retain the original copy of the form at the local health department or provider's office with the child's medical record. Send a copy to the environmental health section of your local health department as a referral for a home lead investigation.
4. A home lead evaluation by an environmental health specialist is required for any child under six years of age with a confirmed blood lead level ≥ 10 $\mu\text{g}/\text{dL}$.

<http://ehs.ncpublichealth.com/docs/forms/cehu/DHHS3651EvalChildWithEBLRev030916FINAL.pdf>

TABLE 3. Clinical Evaluation for Complications of Lead Poisoning

Medical History	Ask about symptoms, developmental history, mouthing activities, pica, previous blood lead level measurements and family history of lead poisoning.
Exposure History (EHS Form 3651)	<ul style="list-style-type: none"> • Ask about age, condition, and any remodeling or repainting of the primary residence and other places where the child spends time (including secondary homes and child care centers). • Ask about occupational and hobby histories of adults with whom the child spends time. Parents can bring home lead dust from their workplace on clothing and shoes. Parental hobbies such as fishing, hunting or bullet making, ceramics and stained-glass work can expose a child to lead. • Ask about other sources of potential lead exposure, including dust or soil in or outside of dwelling, antique furniture, and ingestion of imported or traditional medications, supplements or candy.
Nutritional History	<ul style="list-style-type: none"> • Take a diet history, including the frequency of the child's meals, snacks and beverages. • Assess the child's dietary intake of iron, calcium, vitamin C and zinc. • Ask about the source of water used for cooking, drinking and for preparing infant formula. • Ask about possible ingestion of non-food items. • Ask about participation in WIC and other supplemental nutritional programs and refer if the child's blood lead level is confirmed $\geq 5 \mu\text{g/dL}$.
Physical Examination	Pay attention to growth, the neurologic examination and to the child's psychosocial and language development. A standardized developmental screening test is recommended. Developmental progress should be monitored carefully. If there are delays or lags, the child should be referred to the appropriate agency for further assessment.
Diagnostic testing	<p><u>Laboratory</u>: 1) Evaluate for anemia and iron deficiency 2) Order blood lead testing for this child and other young children in the household 3) Assess renal function if chelation is being considered (for a BLL $\geq 45 \mu\text{g/dL}$)</p> <p><u>Imaging</u>: Order an abdominal X-ray if foreign body ingestion is suspected</p>
Referrals	See the section on Referrals at the end of this chapter

Comments:

- Exposure history. State and local health departments may provide additional information about local exposure sources.
- Nutritional history. Identified nutritional problems should be corrected. Ensure that children are eating at least 3 meals and 2 snacks daily. Smaller and more frequent meals may be helpful since absorption of lead may be increased when the stomach is empty. Deficiencies of iron, calcium and zinc may increase lead absorption or toxicity. Anemia or iron-deficiency without anemia may predispose

the child to pica (ingestion of non-food items) and increase the risk of lead ingestion.

- Physical examination. Findings of language delay or other neurobehavioral or cognitive problems should prompt referral to appropriate programs.

Chelation

Children with confirmed blood lead levels ≥ 45 $\mu\text{g/dL}$ may be candidates for chelation therapy, especially if they have symptoms. The source of the lead exposure must be removed or the child moved to a lead-free environment. Children with confirmed blood lead levels ≥ 70 $\mu\text{g/dL}$ should be hospitalized immediately at a facility with a pediatric intensive care unit (PICU) and considered for chelation, regardless of symptoms. Providers must weigh the risks and benefits of chelation therapy separately for each patient. Initially, chelation will cause a rapid drop in blood lead levels within a week; however, blood lead levels may rise again, and therapy may need to be repeated. Clinicians are strongly encouraged to consult with one of the toxicologists available 24/7 through the Carolinas Poison Center if chelation is being considered. **The Poison Center's telephone number is (800) 222-1222.** If additional resources are needed, contact the NC Childhood Lead Poisoning Prevention Program at (919) 707-5950.

Referrals/Resources

Nutritional Services: Referral to the Women, Infants, and Children (WIC) Program should be considered for all children under five years of age who may be eligible.

WIC Program Eligibility Criteria Includes:

- ◆ Categorical eligibility. A participant who is less than 5 years of age.
- ◆ Residential eligibility. A participant can live anywhere in NC and can go to any local agency. There is no minimum amount of time the participant is required to live in NC in order to receive services.
- ◆ Income eligibility. A family with a gross household income at or below 185% of the Federal Poverty Income Guidelines or a participant receiving Medicaid, Temporary Assistance to Needy Families (TANF) Program (Work First) or Food and Nutrition Services (Food Stamps) automatically meets the income eligibility requirement.
- ◆ Nutritional risk. The participant must have a nutritional assessment and have a medical/nutritional risk diagnosis determined by a Competent Professional Authority (CPA). The nutritional assessment is no cost to the participant and is completed usually at the local agency's WIC office. Examples of nutritional risk criteria includes:

- ◆ Anthropometric measurements that indicate or put a child at risk for being underweight, overweight or short stature
- ◆ A hemoglobin or hematocrit level that indicates iron-deficiency anemia
- ◆ Documented nutrition-related medical conditions
- ◆ Failure to meet Dietary Guidelines
- ◆ Inappropriate nutrition practices
- ◆ Oral health conditions
- ◆ Having a primary caretaker who has limited ability to make feeding decisions and/or prepare food (e.g., mental disability or having a history of abusing alcohol and drugs)

Information about the North Carolina WIC program is available from your county health department or by accessing information on the following website:
<https://www.nutritionnc.com>.

Early Intervention. Children with confirmed lead poisoning (≥ 10 $\mu\text{g/dL}$) are eligible for Early Intervention Services. Children birth to 36 months of age should be referred to the Children’s Developmental Service Agency (CDSA) for Early Intervention as an entitlement of the Individuals with Disabilities Act. The CDSA contact information may be found at <http://www.bearly.nc.gov/index.php/contact/cdsa>.

Care Coordination for Children (CC4C). Children birth to age three who are at risk for developmental delay or disability, long term illness and/or social, emotional disorders and children ages birth to five who have been diagnosed with developmental delay or disability, long-term illness and/or social, emotional disorder may be eligible for the program. For referral information, contact the local health department.

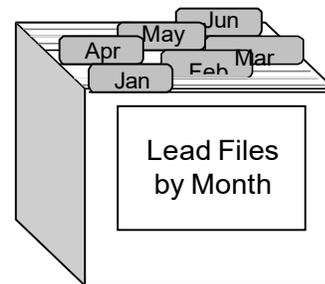
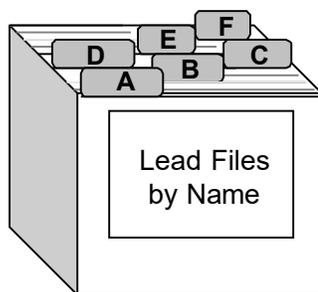
Lead Team. Comprehensive services are best provided by a case-management team that includes the health-care provider, care coordinator, community health nurse or health educator, environmental health specialist, social services liaison, and housing specialist. Coordination of care, environmental services (i.e., identifying and controlling sources of lead exposure) and relocation to safe housing are typically provided or coordinated by the health department.

Housing/Social Services/Educational Services. Refer children to appropriate services if problems such as inadequate housing, lack of routine health care, or need for early intervention educational services are identified. Because childhood lead exposure is often associated with poverty, children with EBLs may also have problems such as inadequate housing, lack of routine medical care, and poor nutrition. Children may also need educational services, and the team may be instrumental in ensuring that children with a history of EBLs receive early intervention or special education services for which they are eligible. The health department may also provide referral sources, such as social service agencies, parent support groups and housing services.

A list of resources, including certified lead abatement contractors and other county-specific resources, for children with lead-poisoning can be found at <https://nchealthyhomes.com/countyresources/>.

Other Helpful Tips

- When testing children for blood lead levels, try to obtain multiple telephone numbers for follow-up contact.
- Lead follow-up is easiest to do when using computerized tickler files. In the absence of these, a double-tickler file system has been used successfully by many health care providers. In this system, first file children's cards/record by name, in order to respond to questions from providers, schools, etc. A second file should be kept by dates, to keep track of testing and follow-up schedules.



- Coordinate WIC Program appointments and lead testing whenever possible to repeat blood tests. When reviewing WIC PROGRAM charts for immunization status, look for blood lead levels.
- Children previously referred to WIC for nutritional assistance need a re-referral for the reason of blood lead levels $\geq 5\mu\text{g/dL}$, so that their nutritional interventions may be tailored to reduce lead absorption.
- Communication between the medical home and the environmental health specialist is critical to ensure that children are not lost to appropriate follow-up. This may be facilitated by meeting at least quarterly to review state surveillance reports.
- **Be sure to use Medicaid numbers on lab slips for children who are on Medicaid!** Including the Medicaid number allows State Laboratory to be reimbursed for processing a specimen, the lead investigations to be reimbursed, and the child's information to be checked against the Medicaid information when there are discrepancies in demographics.

Educating Families



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The first opportunity to educate families about the causes and consequences of a child's elevated blood lead level usually occurs in the health-care provider's office. Education on lead poisoning prevention and the effect of lead on child development should be provided prenatally. [See Chapter 5 for information about lead and testing women during pregnancy.] Parental guidance at these times might prevent lead exposure.

Due to increased mobility and curiosity, a child is at greatest risk of lead poisoning during the second year of life, yet fewer children are tested at 24 months compared to at 12 months of age. When children are 12 and 24 months of age, parental guidance should be provided at well-child visits when the personal-risk questionnaire is administered and/or the blood lead test is performed.

Anticipatory guidance on lead poisoning covers many of the same areas as the **Family Lead Education** provided to children with elevated blood lead levels.

Discuss with families:

- ◆ Their child's blood lead level (if testing has taken place) and what it means.
- ◆ Potential adverse health effects of lead exposure.
- ◆ Sources of lead and suggestions on how to reduce exposure. (See **Chapter 1 Sources** and attached list "**Alternative Cosmetics, Food Additives, and Medicines that Contain Lead**"). Include discussion of ceramic dishes, guns and ammunition, take-home lead from parental occupations and traditional remedies as possible sources of lead. All of these things have caused childhood lead poisoning cases in North Carolina.
- ◆ Wet cleaning is the preferred method to remove lead-contaminated dust on floors, windowsills and other surfaces.
- ◆ Discuss the ineffectiveness of dry methods of cleaning, such as sweeping or vacuuming (unless a High Efficiency Particulate Air (HEPA) filter vacuum is used) for lead removal. A HEPA filter captures particulates of 0.3 microns with 99.97% efficiency (<https://www.ecfr.gov/>, FR §745.83). A vacuum cleaner with a HEPA filter is designed to remove extremely small particles from



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surfaces. However, only a HEPA vacuum, which has a HEPA filter as the last part of the filtration stage and does not allow any air to leak out, should be used to vacuum lead dust.

- ◆ The importance of good nutrition in reducing the absorption of lead. If there are poor eating habits and dietary patterns, discuss ways to improve the diet, and in particular ensure there is adequate intake of iron, vitamin C, calcium and zinc. Encourage regular meals and snacks.
- ◆ The need for follow-up blood lead testing to monitor the child's blood lead level, as appropriate.
- ◆ Hazards of improper removal of lead-based paint. Particularly hazardous are open-flame burning, power sanding, water blasting, methylene chloride-based stripping, and dry sanding or scraping.
- ◆ Other educational materials on lead sources, prevention of exposure, and remediation include the “Do's and Don'ts” brochure (available in English and Spanish), fact sheets located at the end of the manual, and publications from the EPA and other federal agencies' lead programs.

Health departments may provide printed materials and videos to assist in the family education process. Health care providers should discuss short-term repercussions of elevated blood lead levels (e.g., the need for follow-up testing / treatment and the need to control lead hazards in the child's environment) and long-term repercussions (e.g., the potential for future learning problems and the availability of early intervention services).

Chapter 5 Prenatal Lead Testing

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Chapter 5: Prenatal Lead Testing

Key Points

- Lead crosses the placenta, adversely affecting the mother and child during pregnancy.
- Most lead in the body is stored in bone. During pregnancy and lactation, increased bone turnover can release lead into the bloodstream, leading to exposure of the fetus.
- Prenatal exposure to lead has been associated with impaired fetal growth and neurodevelopment, even at low blood lead levels. Maternal lead exposure may increase the risk of hypertension in pregnancy and spontaneous abortion.
- Risk factors for lead exposure during pregnancy and lactation include:
 - Renovation/remodeling of a pre-1978 home
 - Recent immigration
 - Living in a high-risk geographic area
 - Having a household member with an elevated lead level
 - Pica (consumption of non-food items)
 - Occupational exposure to lead (patient or other household member)
 - Poor nutritional status (e.g., anemia, calcium, iron or zinc deficiency)
 - Use of Ayurvedic and other traditional medicines and imported pottery, spices and cosmetics
 - Hobbies such as making stained glass, shooting guns or making bullets, and making ceramics using leaded glaze
- No amount of lead is considered safe, but a confirmed blood lead level (BLL) ≥ 5 $\mu\text{g}/\text{dL}$ is the action level recommended by the Centers for Disease Control and Prevention (CDC) for pregnant women and children. A woman with a confirmed BLL ≥ 10 $\mu\text{g}/\text{dL}$ should be removed from work-related exposure.
- The American College of Obstetricians and Gynecologists and CDC recommend risk-based screening rather than universal screening for *most* pregnant and lactating women. Universal screening is recommended by the CDC for women in high-risk geographic areas. A lead and pregnancy risk questionnaire is available



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in English and Spanish at the end of this chapter and from the NC Division of Public Health, Women's Health Branch Forms website under Maternity Services: <https://whb.ncpublichealth.com/provPart/forms.htm>. A positive response to any question should prompt blood lead testing.

- If the mother's BLL is $<40\mu\text{g/dL}$, she may still breastfeed her baby. However, if the mother's BLL is $\geq 40\mu\text{g/dL}$, her breast milk should be pumped and discarded until the BLL decreases. At-risk women not tested during pregnancy should be tested post-partum if they plan to breastfeed.

Introduction

Testing the blood lead levels (BLLs) of asymptomatic young children has been recommended for decades for secondary prevention of lead poisoning in childhood. The first national public health guidelines for the identification and management of lead exposure in pregnant and lactating women were produced by the Centers for Disease Control and Prevention (CDC) in 2010.[1] The American College of Obstetricians and Gynecologists (ACOG) published a committee opinion paper in 2012 (reaffirmed in 2016) that supported the CDC's recommendations for screening pregnant women.

The assessment of risk factors for lead exposure "should take place at the earliest contact with the pregnant patient." [2]

The purpose of this chapter is to discuss how prenatal exposure to lead can occur, when to order a blood lead test for a pregnant or lactating woman, the harmful effects of lead exposure on the health of mother and baby, and the recommended management of exposed women and resources available through the North Carolina (NC) Division of Public Health. Testing of children is discussed in Chapter 2 of this manual.

Lead absorption, storage and distribution in the body

Lead in the environment enters the human body primarily through ingestion. Lead is absorbed by the gut, then enters the bloodstream and is spread by circulation to organs and bone. Lead readily crosses the placenta, thus exposing the fetus. Umbilical cord blood lead measurements at birth have been shown to correlate with maternal blood lead levels at the time of delivery. Lead in the mother's blood also passes into breastmilk, but at a lower level. It is thought that lead in breast milk reflects approximately 3% of maternal blood lead. [1] Lead can also be inhaled and absorbed by lung tissue. Since lead was removed from gasoline beginning in the 1970s, non-occupational exposure by inhalation is less of a concern. While blood lead is the preferred biomarker for lead exposure, most lead in the body is stored in bone. Pregnancy and lactation are periods when increased

bone turnover may causing leaching of bone lead to the blood. Exposure of the child may occur through cross-placental diffusion or by excretion in breastmilk. Testing bone and breastmilk for lead is not commonly performed unless for research.

Postpartum, breastfeeding is encouraged unless the BLL $\geq 40\mu\text{g/dL}$. If a mother has a BLL $\geq 40\mu\text{g/dL}$, pumping and discarding of breastmilk is recommended until the BLL decreases.

Potential adverse health effects for mother and baby

No level of blood lead is considered “safe” as lead has no known benefit to human health. The most sensitive target for lead toxicity is the central nervous system. Numerous studies have documented the harmful effects of low-level lead exposure on the developing brain leading to problems with learning and behavior. At high levels of lead exposure, brain inflammation and swelling can lead to seizures, coma and death. In children and adults, lead exposure can cause multiple toxic effects including anemia, constipation, fatigue, kidney disease, gout, vascular disease (including hypertension) and balance problems (ataxia). Pregnant women are vulnerable to all the usual adverse effects of lead exposure as well as pregnancy-specific adverse health effects. Elevated lead levels in pregnancy have been associated with gestational hypertension (hypertension that develops after the 20th week of pregnancy without proteinuria), but not with pre-eclampsia or eclampsia.[7] Studies have shown a relationship between high blood lead levels and spontaneous pregnancy loss (miscarriage) as well as lower birth weights.[2] It is important to remember that most lead is stored in bone and that the blood lead level does not reflect the total body burden of lead.

Risk Factors for Exposure

Known risk factors for exposure to lead are listed below. It is important to realize that new risk factors continue to be identified. In the 1990s, vinyl mini-blinds were identified as a source of lead exposure [3]. Recently, lead in imported spices and traditional medicines has been identified as the cause of elevated blood lead levels in children in North Carolina and other states [4, 5]. It is expected that new sources will continue to be identified.

Renovation/remodeling of an older home

In 1978, lead-based paint for residential use was banned in the U.S. Homes built before this date, especially those built before 1960 probably contain lead paint. When disturbed through renovation, repair or painting or if aged paint is peeling, lead dust is created and can be ingested or inhaled. Encourage clients to follow the Environmental Protection Agency (EPA) recommendations for lead-safe renovation, repair and painting (RRP) and

to hire contractors and painters who are certified. A link to a list of RRP-certified contractors in North Carolina can be found at: <http://nchealthyhomes.com/lead-poisoning/>; click on “Find a certified lead professional.”

Recent immigration

Lead paint and leaded gasoline are no longer in common use in the U.S. however, other countries may have less stringent environmental standards. Studies have indicated that women born outside the U.S., especially from parts of central and South America, Africa and Asia, are more likely to have an elevated blood lead level compared to U.S.-born women [1].

Living in a high-risk geographic area

Location near a manufacturing facility, battery reclamation facility or lead smelter increases the risk of exposure. Living in a geographic area with higher numbers of children with elevated BLLs, a large immigrant or refugee population or a high percentage of pre-1978 housing increases the risk that a woman may have lead exposure. Consider universal screening of patients from these areas. Data on higher-risk geographic areas and county-level BLL data are available from the NC Childhood Lead Poisoning Prevention Program at <https://ehs.ncpublichealth.com/hhccehb/cehu/>.

Lead water service lines

While drinking water utilities are required to test for lead in treated water, an individual still may be exposed if the service lines and home water pipes or faucets have lead in the metal or solder. Leaching of lead at the point of use into drinking water may occur if there is corrosion of the supply lines. This was a contributing factor that caused increased lead in drinking water in the city of Flint, Michigan in beginning in 2014.

Occupational exposure to lead

Many people are not aware that there are industries in North Carolina that use or produce lead. Lead dust can be brought into the home or car on contaminated clothing or shoes by the patient or a member of their household. Asking about possible occupational exposure is an important part of the risk assessment. Manufacturing of lead oxide and battery reclamation or manufacture are high-risk industries. [6] Other occupations that are high risk for lead exposure include painting and renovation/remodeling of homes built before 1978, law enforcement, operation or use of shooting ranges and production or use of lead bullets or fishing weights.

Hobbies with a risk of lead exposure

Known hobbies that carry a risk of lead exposure including stained glass making using lead solder, shooting guns (unless lead-free ammunition is used) or making bullets, restoring antique furniture or toys, and making ceramic pottery using leaded glaze. Homeowners living in older homes that are being renovated or DIY (“do it yourself”) renovators are also at risk.

Pica (consumption of non-food items)

Women engaging in pica, the consumption of non-food items, may ingest lead if contaminated soil, painted furniture or metallic items including car keys are chewed or eaten.

Poor nutritional status (e.g., anemia, calcium, iron or zinc deficiency)

Iron deficiency, anemia (lower than normal hemoglobin), calcium and zinc deficiencies can enhance the absorption of lead. Lead can mimic positively charged elements like calcium and insert itself into and disrupt biochemical processes that use these elements. Lead also competes with iron for incorporation into red blood cells.

Use of Ayurvedic and other traditional medicines, imported pottery, spices and cosmetics

An emerging source of lead exposure in North Carolina is the use of imported spices, powders and cosmetics (e.g., surma, kohl) and traditional remedies (e.g., Balguti kesaria). Imported ceramic pottery with lead glaze has been a known source of exposure for some time--use of such items for food storage or preparation is discouraged. Environmental health investigations of children with elevated BLLs in North Carolina 2011-2018 revealed lead contamination of sampled herbal remedies, imported spices and imported ceremonial powders. These findings were published in the CDC Morbidity and Mortality Weekly Report (https://www.cdc.gov/mmwr/volumes/67/wr/mm6746a2.htm?s_cid=mm6746a2_e).

Screening for lead exposure during pregnancy and lactation

The CDC and ACOG recommend the use of a risk assessment tool to identify women who should be screened for lead exposure. If any risk factor is identified, a blood lead test should be ordered. The North Carolina “**Lead and Pregnancy Risk Questionnaire**” for prenatal care patients can be found at the end of this chapter and online at <https://nchealthyhomes.com/lead-poisoning/> and <https://whb.ncpublichealth.com/Forms/4116S-LeadandPregnancyRisk-062618.pdf> in both English and Spanish.

The CDC recommends *universal* screening of pregnant or lactating women who live in a known high-risk geographic area, including those living in an area with a manufacturing facility that produces lead.

Blood lead testing should also be performed if a woman has symptoms that could be explained by lead poisoning. Some symptoms of lead poisoning, such as constipation and fatigue, are non-specific and common in pregnancy [1].

Management of blood lead test results

The recommended public health action level for pregnant women is a *confirmed* BLL ≥ 5 $\mu\text{g}/\text{dL}$. If an initial BLL is elevated, a second venous sample should be drawn and sent to a reference laboratory for confirmation as skin contamination or improper sample collection can lead to falsely elevated blood lead results. The NC Public Health Follow- Up Schedule is found in **Table 1**. Beginning in July 2017, any pregnant woman with a *confirmed* BLL at or above the action level of $5\mu\text{g}/\text{dL}$ is eligible for a free environmental health assessment to identify the source of lead exposure. These assessments are done by registered environmental health specialists based at the state and local health departments. Prenatal care providers must refer patients for the environmental assessments using the referral form at the end of this chapter and online at <https://whb.ncpublichealth.com/provPart/docs/matHealthManual/PrenatalLeadInvestigationReferralForm-FINAL-Dec2017.pdf>

Chelation

Using a chelating agent to rapidly lower the blood lead level may be considered on an individual case basis for women with a confirmed BLL $\geq 45\mu\text{g}/\text{dL}$. These cases should be considered as high-risk pregnancies and specialists in high-risk obstetrics and medical toxicology should be consulted regarding management. [1] The most immediate action should be intervention(s) to stop further lead exposure. In some cases, hospitalization of the patient may be required. BLLs $\geq 70\mu\text{g}/\text{dL}$ may cause significant toxicity, including cerebral edema (brain swelling), and should be treated as a medical emergency.

Medical providers can contact **NC CLPPP** at **(919) 707-5950** or call NC Poison Control at (800) 222-1222 if urgent medical toxicology consultation is needed.

Nutrition and Lead Poisoning

For women with a BLL $\geq 5\mu\text{g}/\text{dL}$, the CDC recommends a total daily calcium intake of 2,000mg through diet and supplementation. Women should also be screened for iron deficiency and treated as per usual recommendations for pregnancy. Zinc deficiency is uncommon in the U.S. and no routine testing is recommended.

Ordering Prenatal Blood Lead Tests in North Carolina

- Any prenatal care provider can order a prenatal blood lead test. All tests should be from venous (not capillary) samples and analysis should be done at a reference laboratory (not on a point-of-care lead analyzer).
- **New** - Lead testing will be provided *at no charge* by the State Laboratory of Public Health for women tested at local health departments. The policy and a useful reference chart for follow-up testing and interventions based on BLL can be found at the end of this chapter and online at the Women’s Health Branch website in the *Maternal Health Policy Manual* section under “Lead and Pregnancy”: <https://whb.ncpublichealth.com/provPart/docs/matHealthManual/NC-LeadPregnancyPolicyFINAL2018V9-July27-2018.pdf>
- **New** - Any provider can make a referral for a home lead investigation by the local health department environmental health staff when a pregnant woman is found to have two consecutive venous blood lead levels $\geq 5\mu\text{g/dL}$ within a 12-month period. To make a referral, the provider should fax the completed **Prenatal Lead Investigation Referral** form to the NC Childhood Lead Poisoning Prevention Program at 919- 841-4015. This form can be found at the end of this chapter and at the Women’s Health Branch website in the *Maternal Health Policy Manual* section under “Lead and Pregnancy”:
<https://whb.ncpublichealth.com/provPart/docs/matHealthManual/PrenatalLeadInvestigationReferralForm-FINAL-Dec2017.pdf>

Table 1: Clinical Follow-Up for Pregnant Women

Initial Blood Lead Results	Frequency of Follow-Up Testing	Recommended interventions according to BLL in Pregnancy
<5 µg/dL	No confirmatory or follow-up testing necessary	<ul style="list-style-type: none"> • Educate about lead exposure sources and risk reduction
5-9 µg/dL	<p>Conduct confirmatory testing <u>within 1 month</u> and follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are <5µg/dL</p> <p><i>Recommend that the baby's medical provider be alerted to the maternal elevated blood lead level.</i></p>	<p><i>Above actions in addition to:</i></p> <ul style="list-style-type: none"> • Provide case management • Attempt to determine source of lead exposure (home, work, pica) • Counsel on strategies to reduce exposure • Assess for adequacy of patient's diet • Provide prenatal vitamins and nutritional guidance emphasizing adequate Calcium and Iron intake with Vitamin C to enhance absorption <p>For occupationally exposed patients (yes to question #6 on questionnaire) review safe work practices: hand washing, showering before going home, proper laundering of work clothes</p> <ul style="list-style-type: none"> • Provide patient with the following: "Lead Facts" and "Lead and Your Occupation" • If required by employment, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	Conduct confirmatory testing <u>within 1 month</u> and follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are <5µg/dL	<p><i>Above actions in addition to:</i></p> <ul style="list-style-type: none"> • Recommend removal from workplace lead exposure

25-44 µg/dL	Confirmatory test <u>within 1-4 weeks</u> and follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are <5µg/dL	<i>Above actions in addition to:</i> <ul style="list-style-type: none"> • Advise not to breastfeed and discard breastmilk if BLL ≥40µg/dL • Testing milk is not recommended
≥ 45 µg/dL	<p>Confirmatory test <u>within 24 hours</u> and then at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs</p> <p>Should be considered and treated as high-risk pregnancy</p> <p>Patient may require hospitalization or transfer of care to a high-risk obstetrical practice</p>	<i>Above actions in addition to:</i> <ul style="list-style-type: none"> • Consult a provider (e.g., medical toxicologist) specializing in lead poisoning treatment before considering chelation for the patient

References

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2. Lead screening during pregnancy and lactation. Committee Opinion No. 533. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2012; 120: 416-20
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7. Rabinowitz M, Bellinger D, Leviton A, Needleman H, Schoenbaum S. Pregnancy hypertension, blood pressure during labor, and blood lead levels. *Hypertension*. 1987;10(4):447–51. doi: 10.1161/01.HYP.10.4.447.

FORMS AND EDUCATIONAL RESOURCES

Lead and pregnancy risk questionnaire (English)

<https://whb.ncpublichealth.com/Forms/4116E-LeadandPregnancyRisk-062618.pdf>

Bilingual lead and pregnancy risk questionnaire (English/Spanish)

<https://whb.ncpublichealth.com/Forms/4116S-LeadandPregnancyRisk-062618.pdf>

Prenatal lead investigation referral form

<https://whb.ncpublichealth.com/provPart/docs/matHealthManual/PrenatalLeadInvestigationReferralForm-FINAL-Dec2017.pdf>

NC Public Health, Maternal Health, “Lead and Pregnancy” policy (includes table of recommended follow-up testing intervals and interventions based on blood lead level; Table 1)

<https://whb.ncpublichealth.com/provPart/docs/matHealthManual/NC-LeadPregnancyPolicyFINAL2018V9-July27-2018.pdf>

Summary of Actions based on Maternal and Infant Blood Lead Levels

<https://whb.ncpublichealth.com/Manuals/SummaryChart-clinics.pdf>

PATIENT EDUCATION

Lead and Pregnancy brochure (English)

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Pregnancy_July-2017_English_for-web.pdf

Lead and Pregnancy brochure (Spanish)

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Pregnancy_July-2017_Spanish_for-web.pdf

**NC Childhood Lead Testing and
Follow-Up Manual Appendix**

Appendix A: Glossary

Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. Part of the Occupational and Environmental Epidemiology Branch in the Division of Public Health. Identifies and monitors cases of elevated blood lead levels in adults.

Blood Lead Level (BLL). A measure of the amount of lead in the blood.

Care Coordination for Children (CC4C). Provides formal care coordination and case management services at no charge to eligible children birth to five at risk for or diagnosed with special needs and their families. Services are provided by local health departments, Sickle Cell Agencies, Federally Qualified Health Centers and Rural Health Centers to children not enrolled in the Infant-Toddler Program. For more information, call your local health department or the Children with Special Health Care Needs Help Line, 1-800-737-3028 or email CYSHCN.Helpline@dhhs.nc.gov.

Children's Developmental Services Agency (CDSA). Provides evaluation and intervention services primarily birth to age three. Serves as the local head agency for the Early Intervention Infant-Toddler Program. Contact information may be found at <http://www.bearly.nc.gov/index.php/contact/cdsa>

Clinical Management. Comprehensive follow-up care, usually given by a health care provider to a child with an elevated blood lead level. Clinical management includes:

1. Clinical evaluation for complications of lead poisoning (*Chap 4-Table 3*)
2. Family lead education and referrals.
3. Chelation therapy, if appropriate.
4. Follow-up testing at appropriate intervals.

Confirmed lead poisoning (CLP). A blood lead concentration of 10 µg/dL or greater, determined by the truncated value of the lower of two consecutive blood tests within a 12-month period.

Diagnostic Test. A laboratory test for lead that is performed on the blood of a child who has a screening blood level of 5µg/dL or greater. The diagnostic test is usually the first venous blood lead test performed within three months of the screening test.

Early Intervention. Identification of young children who have a developmental delay or may be at risk for developing problems and providing different types of services to support the family and the child. Early Intervention services are provided by many agencies under the leadership of the local CDSA.

Elevated Blood Lead Level (EBL). A blood lead concentration of ≥5-9 µg/dL determined by truncated value of the lower of two consecutive blood tests within a one-

month period.

Environmental Health Specialist (EHS). A trained individual who inspects areas for environmental hazards and ensures that environmental health regulations are followed to protect the health of the public. In NC, these individuals may be registered by the [NC State Board of Environmental Health Specialist Examiners \(https://ncrehs.com/\)](https://ncrehs.com/).

Exposure. Contact with a chemical, infectious agent, radiation, or extreme weather event, which has the potential to harm an individual.

Family Lead Education. This service provides families with prompt and individualized education regarding:

1. Their child's blood lead level, and what it means.
2. Potential adverse health effects of lead exposure.
3. Sources of lead and suggestions on how to reduce exposure.
4. The importance of wet cleaning to remove lead-contaminated dust on floors, windowsills, and other surfaces; the ineffectiveness of dry methods of cleaning, such as sweeping.
5. The importance of good nutrition in reducing the absorption of lead. If there are poor nutritional patterns, discuss adequate intake of calcium, iron and zinc and encourage regular meals and snacks.
6. The need for follow-up blood lead testing to monitor the child's blood lead level, as appropriate.
7. Results of environmental investigation, as appropriate.
8. Hazards of improper removal of lead-based paint. Particularly hazardous are open-flame burning, power sanding, water blasting, methylene chloride-based stripping, and dry sanding or scraping.

Follow-up Test. A laboratory test for lead that is performed in order to monitor the status of a child with an elevated diagnostic blood lead test.

Initial Blood Lead Test. A laboratory test for lead that is performed on the blood of an asymptomatic child (or pregnant woman) to determine if the child (or pregnant woman) has an elevated blood lead level.

NC CLPPP (North Carolina Childhood Lead Poisoning Prevention Program). Part of the Children's Environmental Health Program in the Division of Public Health, Environmental Health Section - administers the NC CLPPP and Childcare and School Sanitation Inspection Programs. NCLPPP handles clinical and environmental investigations for children (and pregnant women as of 2017) with elevated blood lead levels.

Point-Of-Care (POC) Blood Lead Analyzers. Use of POC analyzers provide an immediate initial blood lead test result which reduces delays in obtaining diagnostic (i.e., confirmatory) samples to confirm elevated initial results. POC lead analyzers are only

approved for testing capillary (fingerstick) samples. Current POC analyzer on the market should not be used to analyze venous samples due to inaccurate results. All clinics that use a POC analyzer for lead testing are **required** to report all blood lead test results for children less than six years old residing in North Carolina to the North Carolina Childhood Lead Poisoning Prevention Program.

Reference Value. A value based on the 97.5th percentile of the blood lead level (BLL) distribution among children 1–5 years old in the United States using data generated by the National Health and Nutrition Examination Survey (NHANES). Currently the reference value to identify children with elevated BLLs is 5 µg/dL.

Refugee. Refugees are a special group of immigrants who are admitted into the United States because of persecution or a well-founded fear of persecution on account of race, religion, nationality, membership in a particular social group, or political opinion. These individuals enter the United States legally as a refugee pursuant to Section 207 of the Immigration and Naturalization Act. For the most part, refugees cannot return home because of the danger they would face upon returning.

WIC Program. WIC stands for Women, Infants, and Children. This program is also called the Special Supplemental Nutrition Program for Women, Infants, and Children. WIC is a federal program for low-income pregnant, postpartum and breastfeeding women, infants and children until the age of five and provides supplemental foods, nutrition education, breastfeeding support, and referrals for health care. WIC is effective in preventing and improving nutrition-related health problems within its target population.

Appendix B: Contact Information

NORTH CAROLINA LEAD CONTACTS

NC CHILDHOOD LEAD POISONING PREVENTION PROGRAM (CLPPP)

DAVID BROWN, SURVEILLANCE COORDINATOR

Children's Environmental Health Program
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Department of Health and Human Services
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◆ *Surveillance, Medicaid Billing, Regional Specialist for Counties: Chatham, Durham, Lee, Orange*

MELANIE NAPIER, PUBLIC HEALTH EPIDEMIOLOGIST

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◆ *Programmatic and Policy Guidance, Public Outreach, CDC Lead Grant Principal Investigator*

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◆ Clinical workshop coordinator, continuing education hours, technical assistance

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◆ *Blood Lead Analysis*

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◆ Environmental Sample Analysis

Appendix B: Contact Information

OTHER LEAD CONTACTS

DR. MICHAEL BEUHLER, MEDICAL DIRECTOR

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◆ *Clinical Consultation on Chelation*

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◆ *WIC, Nutrition*

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- ◆ CDC Childhood Lead Poisoning Prevention Grant; Lead and Healthy Homes training, Educational Materials

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- ◆ *Refugee health program*

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- ◆ *Lead waste disposal regulations*

Appendix C: Recent Memoranda

Prelude to Medicaid Special Bulletin Re: Point of Care Lead Analyzers

Page 2 of the Medicaid Special Bulletin contains outdated policy language to round the blood lead test result to the next whole number. As of July 1, 2017, the need for confirmation testing is based on the *truncated* test result, not the rounded one.

An update is provided on the page, stating:

UPDATE: Confirmation is now based on the *truncated* test result. Test results ≥ 4.0 and $< 5.0\mu\text{g/dL}$ should be *truncated* to $4.0\mu\text{g/dL}$.

Due to the fact that the bulletin was published in 2015, links throughout may no longer be active.

Prelude to Memo re: Point of Care Lead Analyzers

The 2015 Memo from Kim Gaetz references outdated contact/phone information as Kim Gaetz no longer works for NC CLPPP.

The contact name and phone number to call to make arrangements for reporting of blood lead test results have changed.

Please call Tena Hand at (919) 707-5933. We will work with you to help you meet these reporting requirements.

North Carolina Medicaid Special Bulletin



An Information Service of the
Division of Medical Assistance

Visit DMA on the Web at <http://www.ncdhhs.gov/dma>

September 2015

Attention: Pediatric Service Providers

Childhood Blood Lead Testing, Reporting, and Follow-up Requirements for Point of Care (POC) Lead Analyzer (i.e., LeadCare) Laboratories

*Providers are responsible for informing their billing agency of information in this bulletin.
CPT codes, descriptors, and other data only are copyright 2014 American Medical Association.
All rights reserved. Applicable FARS/DFARS apply.*

Reminder of Childhood Blood Lead Testing Requirements

All Medicaid-enrolled children are required to be tested at 12- and 24-months of age by a clinical laboratory that is licensed by the Clinical Laboratory Improvement Amendments of 1988 (CLIA) for blood lead analysis. Children between 36- and 72-months of age must be tested if they have not previously been tested. Capillary blood lead samples are adequate for the initial blood lead test. Venous blood lead samples should be collected **as soon as possible** for confirmation of all initial blood lead test results ≥ 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$) and when a diagnostic or follow-up test result falls in a higher risk category. Capillary blood lead measurements may be used for initial testing purposes, but venous blood is appropriate for diagnostic evaluation using only a high complexity laboratory methodology and prior to initiating an environmental investigation or medical management. **UPDATE: Confirmation is now based on the truncated test result. Test results ≥ 4.0 and $< 5.0 \mu\text{g}/\text{dL}$ should be truncated to $4 \mu\text{g}/\text{dL}$.**

Note: The need for confirmation testing is based on the rounded test result. For example, test results between 4.5 to 4.9 $\mu\text{g}/\text{dL}$ should be rounded up to 5 $\mu\text{g}/\text{dL}$.

Use of Point of Care (POC) Lead Analyzers and Public Health Implications

POC blood lead analyzers have great public health potential providing the advantage of an immediate test result while the patient is still at the clinic. This is a distinct advantage in North Carolina because, under state law, two consecutive elevated test results are required in order to initiate follow-up services. The diagnostic blood lead sample can be collected during the same clinic visit, hence, eliminating the need to track down children for return testing, which often results in long delays before necessary follow-up services can be provided.

There are significant drawbacks to this technology as well. As with other CLIA-waived laboratory instruments, there is no requirement for documentation of employee training and competency, ongoing proficiency testing, or monitoring of quality control. Calibration of the LeadCare II instrument (the only waived POC analyzer on the market) is not electronically documented. In addition, this technology uses anodic stripping voltammetry, a technology abandoned for blood lead analysis by the State Laboratory of Public Health (State Lab) more than 20 years ago largely because of poor precision at lower blood lead levels.

Although state law requires laboratories to electronically submit all blood lead test results for children within five working days after test completion to the Division of Public Health (DPH), compliance and technical expertise of staff at the provider laboratories varies considerably. This has resulted in major issues with timely reporting and poor data quality. File submission from some POC laboratories is sporadic, and some just stop reporting altogether. Lack of reporting has resulted in missed identification of children in need of follow-up services. It also has a negative impact on data-driven, evidence-based decision-making and public health strategies.

POC Lead Analyzer Laboratory Requirements

Facilities using a POC lead analyzer need to be aware that CLIA designates them as a laboratory. Therefore, all POC laboratories must enroll in and meet requirements of CLIA, must follow all North Carolina Childhood Lead Poisoning Prevention Program (NC CLPPP) Testing and

Follow-up Recommendations, and must comply with North Carolina blood lead test reporting requirements (G.S. § 130A-131.5 to 131.8) below.

Note: Our state requirements go beyond the minimum requirements set forth by CLIA or the Commission on Office Laboratory Accreditation (COLA).

Diagnostic (i.e., Confirmation) Testing

While a useful screening tool, POC blood lead analyzers have a limit of detection of 3.3 µg/dL which is barely sufficient to identify children at the Centers for Disease Control and Prevention (CDC) reference value of 5 µg/dL. Because of limitations at lower blood lead levels, both the manufacturer and the CDC recommend against using POC analyzers for diagnostic testing. Therefore, the state requires the immediate collection of a diagnostic specimen for analysis by an outside reference laboratory* – without any repeat analysis using the POC analyzer before sending the diagnostic specimen out.

Note: The State Lab will analyze blood lead specimens for all children less than 6 years of age (and refugee children through 16 years) at no charge to the Medicaid or N.C. Health Choice (NCHC) beneficiary. Providers are encouraged to use the State Lab as it expedites test result reporting.

* CLIA certified laboratory using an analytical method categorized by CLIA as a high complexity test.

Blood Lead Test Result Reporting Requirements

POC lead analyzer laboratories must comply with state mandated reporting requirements.

North Carolina General Statute § 130A-131.8. Laboratory reports.

- (a) All laboratories doing business in this state shall report to the Department all environmental lead test results and blood lead test results for children less than 6 years of age and for individuals whose ages are unknown at the time of testing. Reports shall be made by electronic submission within five working days after test completion.
- (b) Reports of blood lead test results shall contain all of the following:
 - (1) The child's full name, date of birth, sex, race, ethnicity, address, and Medicaid number, if any.
 - (2) The name, address, and telephone number of the requesting health care provider.
 - (3) The name, address, and telephone number of the testing laboratory.
 - (4) The laboratory results, whether the specimen type is venous or capillary; the laboratory sample number, and the dates the sample was collected and analyzed.

Additionally, POC lead analyzer laboratories must maintain documentation of instrument calibration and quality control testing, dates blood lead test result files are submitted to the state, and outside reference laboratory used for analysis of diagnostic tests.

Billing for POC Lead Analyzers and Follow-up Diagnostic Tests

Providers that use a POC lead analyzer may bill the usual and customary charge for the blood lead analysis using CPT code 83655. Diagnostic (confirmation) tests may be analyzed by the State Lab at no charge to the patient. Again, diagnostic tests should **not** be performed on the POC lead analyzer.

Additional Resources

For more information about blood lead testing guidelines and reporting requirements, providers can consult the following websites and documents:

- [NC General Statute for Lead Poisoning in Children G.S. § 130A-131.5 to 131.8](#)
(See p.1-4)
- [CDC Recommendations for Revised Blood Lead Testing Follow-up Schedule](#)
(2 pages)
- [NC Childhood Lead Testing and Follow-up Manual](#)
- [NC Childhood Lead Poisoning Prevention Program Resources](#)
- [NC State Laboratory of Public Health](#)

Sandra Terrell, MS, RN
Director of Clinical
Division of Medical Assistance
Department of Health and Human Services

Paul Guthery
Executive Account Director
CSC



North Carolina Department of Health and Human Services
Division of Public Health

Pat McCrory
Governor

Richard O. Brajer
Secretary

Daniel Staley
Acting Division Director

September 22, 2015

MEMORANDUM

TO: Blood Lead Laboratories

FROM: Kim Gaetz, Public Health Epidemiologist
Children's Environmental Health Program

SUBJECT: Point-of-care lead analyzers

The Clinical Laboratory Improvements Amendments (CLIA) designates facilities that use point-of-care (POC) lead analyzers (i.e. LeadCare II) as laboratories. Blood lead test results, even if determined in a clinical setting, are required to be reported.

All blood lead test results are required to be reported by electronic submission within five working days after test completion for children less than six years of age and for individuals whose ages are unknown at the time of testing (please see below). Examples of approved electronic formats are datafiles such as .xml format (LeadCare report format), Excel file formats, or Access file formats.

**North Carolina General Statute
§ 130A-131.8. Laboratory reports.**

- (a) All laboratories doing business in this State shall report to the Department all environmental lead test results and blood lead test results for children less than six years of age and for individuals whose ages are unknown at the time of testing. Reports shall be made by electronic submission within five working days after test completion.
- (b) Reports of blood lead test results shall contain all of the following:
 - (1) The child's full name, date of birth, sex, race, ethnicity, address, and Medicaid number, if any.
 - (2) The name, address, and telephone number of the requesting health care provider.
 - (3) The name, address, and telephone number of the testing laboratory.
 - (4) The laboratory results, whether the specimen type is venous or capillary; the laboratory sample number, and the dates the sample was collected and analyzed.

To make arrangements for reporting of blood lead test results, please call (919) 707-5953. We will work with you to help you meet these reporting requirements.

**UPDATE: Please call (919) 707-5933 to
arrange blood lead test result reporting.**

www.ncdhhs.gov • www.publichealth.nc.gov

Tel 919-707-5950 • Fax 919-870-4808

Location: 5505 Six Forks Road • Raleigh, NC 27609

Mailing Address: 1912 Mail Service Center • Raleigh, NC 27699-1912

An Equal Opportunity / Affirmative Action Employer





North Carolina Department of Health and Human Services
State Laboratory of Public Health

Pat McCrory
Governor

Aldona Z. Vos, M.D.
Ambassador (Ret.)
Secretary DHHS

Scott J. Zimmerman, DrPH, MPH, HCLD (ABB)
Laboratory Director

Memorandum

Blood Lead teleform implementation at the North Carolina State Laboratory of Public Health

Beginning November 12, 2014 the Blood Lead Unit of the Hemachemistry Lab at the North Carolina State Laboratory of Public Health (NCSLPH) will begin using a new form to increase productivity and reduce errors in reports. This new form will be available on the NCSLPH website at: <http://slph.ncpublichealth.com/forms.asp#specimen>. **Form DHHS-3707.**

This form is designed to be scanned. A NCSLPH data entry person will manually verify any letters or numbers that the computer cannot interpret. Please help us to save time and improve accuracy by writing carefully and following the instructions below. Please use X instead of √ for check boxes.

For optimum accuracy, please print in capital letters and avoid contact with the edge of the box. Follow the sample letters and numbers as closely as possible.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	0			

Patient Information: Print the information if the standard label/HSIS Laboratory Label is not attached. Do not attach any other label format. The standard label format is available from the **Hemachemistry office**. Please align the label in the box on the top right of the form. The label must fit within the box, not touch the lines on the edge of the box, and the printed information must be parallel to the top of the box. Labels placed at an angle will not be read accurately.

Please Note: If you need additional copies of the submission form, please do NOT photo copy. Instead, print them from the original PDF found on the State Lab's website ON WHITE PAPER only. Colored paper will not be able to be scanned. Or you may call the Hemachemistry office at 919-807-8878 to have an electronic copy emailed to you.



Appendix D: Forms

NORTH CAROLINA COUNTY CODES

001 Alamance	026 Cumberland	051 Johnston	076 Randolph
002 Alexander	027 Currituck	052 Jones	077 Richmond
003 Alleghany	028 Dare	053 Lee	078 Robeson
004 Anson	029 Davidson	054 Lenoir	079 Rockingham
005 Ashe	030 Davie	055 Lincoln	080 Rowan
006 Avery	031 Duplin	056 Macon	081 Rutherford
007 Beaufort	032 Durham	057 Madison	082 Sampson
008 Bertie	033 Edgecombe	058 Martin	083 Scotland
009 Bladen	034 Forsyth	059 McDowell	084 Stanly
010 Brunswick	035 Franklin	060 Mecklenburg	085 Stokes
011 Buncombe	036 Gaston	061 Mitchell	086 Surry
012 Burke	037 Gates	062 Montgomery	087 Swain
013 Cabarrus	038 Graham	063 Moore	088 Transylvania
014 Caldwell	039 Granville	064 Nash	089 Tyrrell
015 Camden	040 Greene	065 New Hanover	090 Union
016 Carteret	041 Guilford	066 Northampton	091 Vance
017 Caswell	042 Halifax	067 Onslow	092 Wake
018 Catawba	043 Harnett	068 Orange	093 Warren
019 Chatham	044 Haywood	069 Pamlico	094 Washington
020 Cherokee	045 Henderson	070 Pasquotank	095 Watauga
021 Chowan	046 Hertford	071 Pender	096 Wayne
022 Clay	047 Hoke	072 Perquimans	097 Wilkes
023 Cleveland	048 Hyde	073 Person	098 Wilson
024 Columbus	049 Iredell	074 Pitt	099 Yadkin
025 Craven	050 Jackson	075 Polk	100 Yancey

EXPOSURE HISTORY OF CHILD WITH ELEVATED BLOOD LEAD LEVEL

1. Last Name		First Name				M I			
2. Medicaid No. or SSN									
3. Date of Birth				4. Hispanic Origin? <input type="checkbox"/> Yes <input type="checkbox"/> No					
5. Race		<input type="checkbox"/> White	<input type="checkbox"/> Black	<input type="checkbox"/> American Indian					
		<input type="checkbox"/> Asian	<input type="checkbox"/> Pacific Island.	<input type="checkbox"/> Other					
6. Sex		<input type="checkbox"/> Male		<input type="checkbox"/> Female					
7. County of Residence:									
8. Refugee status?								<input type="checkbox"/> Yes <input type="checkbox"/> No	

Current Address of Child: _____ Phone: (____) _____

Length of Residence at Child's Current Address: _____ years _____ months

Parent/Guardian Name: _____

Laboratory Findings: Date: _____ Blood Lead: _____
 Date: _____ Blood Lead: _____
 Date: _____ Blood Lead: _____

Dietary History:

- Yes No
- Does the family store food in open cans?
 - Does the family prepare, store, or serve food in homemade or imported ceramic dishes?
 - Does the family use traditional medicines such as greta, azarcon or pay-loo-ah?
 - Does the family cook with imported spices?
 - Does the child receive iron, calcium or phosphorus supplements?
 - Is the child enrolled in the WIC program?

Comments: _____

Possible Non-food Sources of Child's Lead Exposure:

- | Yes | No | | Explain |
|--------------------------|--------------------------|---|---------|
| <input type="checkbox"/> | <input type="checkbox"/> | Does child play in dirt? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Does child put fingers in mouth? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Have you ever seen child eat a paint chip, plaster or chew on painted surfaces? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Does child eat or chew on other non-food items? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Does family recycle or store old car batteries? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Does family use the following for fuel:
painted boards? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | battery casings? | _____ |
| <input type="checkbox"/> | <input type="checkbox"/> | Are there plastic or vinyl miniblinds at the child's home? | _____ |

Possible Non-food Sources of Child's Lead Exposure: (Continued)

Yes	No		Explain
<input type="checkbox"/>	<input type="checkbox"/>	Is there peeling paint or plaster inside or out at the child's primary residence?	_____
<input type="checkbox"/>	<input type="checkbox"/>	Is the primary residence being remodeled or has it been remodeled during the past six months?	_____
<input type="checkbox"/>	<input type="checkbox"/>	Do any family members work in battery salvage, car repair or painting, smelting or house renovating?	_____
<input type="checkbox"/>	<input type="checkbox"/>	Do any family members have a hobby or job that involves hunting; target shooting; fishing; furniture repair; making bullets, pottery or stained glass?	_____
<input type="checkbox"/>	<input type="checkbox"/>	Was the child born in a country other than the United States?	_____

Approximate Age of Dwelling: _____ Owner of Dwelling: _____

Number of children in household less than 6 years old:	Tested for lead poisoning during past six months?
Name/age _____ / _____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____ / _____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____ / _____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____ / _____	<input type="checkbox"/> Yes <input type="checkbox"/> No

INTERVIEWER: Have I completed the following?	Yes	No	Comments
Discussed effects of lead poisoning and need for patient follow-up.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Provided education on house cleaning measures to prevent lead poisoning.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Provided nutritional information to reduce lead absorption.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Made arrangements for subsequent laboratory testing.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Has referral been made to physician if needed?	<input type="checkbox"/>	<input type="checkbox"/>	_____
If yes, give date and time: _____			_____
Explained reason for environmental investigation.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Referred to local health department for environmental investigation.	<input type="checkbox"/>	<input type="checkbox"/>	_____

Date: _____ INTERVIEWER: _____

Purpose: To be used by the health care provider to determine potential sources of lead exposure for a child with an elevated blood lead level and to educate the family about lead poisoning.

Preparation: Fill in the blanks and check the appropriate answers. **Fax a copy to (919) 841-4015.**

Distribution: Retain original at county health department with child's record. Send a copy to the lead investigator upon a referral for an environmental investigation.

Disposition: This form may be destroyed in accordance with Standard 5 of the *Records Disposition Schedule* published by the North Carolina Division of Archives and History.

Additional forms may be ordered from:

Environmental Health Section
 Division of Public Health
 Children's Environmental Health Unit
 1934 Mail Service Center
 Raleigh, NC 27699-1934
 Phone: (919) 707-5854

NC Department of Health and Human Services
Division of Public Health

LEAD RISK ASSESSMENT QUESTIONNAIRE

Patient's Name:

Medical Record Number:

Purpose: For clinical use to identify children who need to be tested for lead exposure.

Instructions: At 12 and again at 24 months of age (or at the time of the clinic visit closest to these ages) determine the zip code for all children. Note: If the mailing and residential addresses are not the same, use the zip code of the physical address where the child lives. Also determine the zip code for children between 24 and 72 months of age who have never been tested or for whom testing status is unknown. Conduct a blood lead test for all children who live in one of the high risk zip codes listed on the back of this page. For children who do not live in a high risk zip code ask the assessment questions below. Conduct a blood lead test if the answer to any question is **yes** or **I don't know**.

Reordering Information: Additional copies of this form may be ordered from:
Environmental Health Section
Division of Public Health
1632 Mail Service Center
Raleigh, NC 27699-1632
Telephone: 888-774-0071

Date:	Age:	Residential Zip Code:
1.	Receive Women, Infants, and Children (WIC) Program Services or is your child enrolled in Medicaid (Health Check) or Health Choice?	
2.	Live in or regularly visit a house that was built before 1950, including home child care centers or homes of relatives?	
3.	Live in or regularly visit a house that was built before 1978, with recent or ongoing renovations or remodeling (within the last 6 months)?	
4.	Live in or regularly visit a house that contains vinyl miniblinds?	
5.	Have a brother, sister, other relative, housemate or playmate who has or has had a high blood lead level?	
6.	Is your child a refugee, immigrant or adopted from another country?	

Date:	Age:	Residential Zip Code:
1.	Receive Women, Infants, and Children (WIC) Program Services or is your child enrolled in Medicaid (Health Check) or Health Choice?	
2.	Live in or regularly visit a house that was built before 1950, including home child care centers or homes of relatives?	
3.	Live in or regularly visit a house that was built before 1978, with recent or ongoing renovations or remodeling (within the last 6 months)?	
4.	Live in or regularly visit a house that contains vinyl miniblinds?	
5.	Have a brother, sister, other relative, housemate or playmate who has or has had a high blood lead level?	
6.	Is your child a refugee, immigrant or adopted from another country?	

North Carolina Zip Codes for Children at High Risk for Lead Exposure

Conduct a blood lead test on all children who live in one of these zip codes.

27011	27405	27810	27871	27954	28137	28365	28463	28581	28752
27013	27406	27812	27872	27956	28139	28367	28464	28585	28753
27014		27813	27873	27957	28144	28368	28466	28586	28755
27016	27504	27814	27874	27960	28150	28369	28469		28756
27024	27508	27816	27875	27962	28159	28371	28470	28604	28757
27028	27510	27818	27876	27964	28160	28372	28471	28611	28761
27030	27521	27819	27877	27965	28169	28373	28472	28615	28762
27042	27530	27820	27878	27967	28170	28376	28478	28616	28771
27046	27534	27821	27882	27970		28377	28479	28621	28772
27047	27536	27822	27883	27973	28208	28379		28622	28777
27052	27542	27823	27884	27974		28382	28501	28623	28779
27053	27544	27824	27885	27979	28301	28383	28504	28624	28781
	27546	27826	27886	27980	28303	28384	28510	28627	28782
27101	27549	27827	27888	27982	28305	28385	28511	28635	28789
27105	27551	27828	27889	27983	28306	28386	28513	28637	28792
27107	27553	27829	27890	27985	28315	28390	28515	28640	
	27555	27830	27891	27986	28318	28393	28516	28642	28801
27202	27557	27831	27892		28323	28394	28518	28644	
27212	27559	27832	27893	28001	28325	28395	28519	28657	28909
27217	27563	27839	27897	28007	28326	28396	28521	28659	
27239	27565	27840		28009	28328	28398	28523	28662	
27242	27568	27841	27909	28018	28330	28399	28525	28663	
27252	27569	27843	27910	28019	28332		28526	28666	
27260	27570	27844	27915	28020	28333	28401	28528	28669	
27262	27573	27845	27919	28032	28334	28422	28529	28670	
27263	27576	27846	27922	28034	28338	28430	28530	28675	
27288	27577	27847	27923	28040	28339	28431	28531	28679	
27291	27582	27849	27924	28043	28340	28432	28537	28681	
	27584	27850	27925	28072	28342	28434	28538	28685	
27305	27589	27851	27926	28073	28343	28435	28551		
27306		27852	27928	28076	28345	28438	28552	28702	
27311	27601	27853	27932	28077	28349	28439	28553	28705	
27314		27855	27935	28083	28350	28441	28554	28708	
27341	27701	27856	27937	28089	28351	28444	28555	28710	
27342		27857	27938		28352	28447	28556	28714	
27343	27801	27860	27941	28101	28356	28448	28557	28725	
27360	27803	27862	27942	28102	28357	28450	28560	28726	
27371	27804	27863	27944	28114	28358	28452	28570	28733	
27379	27805	27864	27946	28119	28360	28456	28572	28734	
	27806	27866	27947	28127	28362	28457	28573	28735	
27401	27807	27869	27950	28128	28363	28458	28577	28743	
27403	27809	27870	27953	28135	28364	28462	28580	28746	

BLOOD LEAD ANALYSIS

NC Department of Health and Human Services
 State Laboratory of Public Health
 4312 District Drive P.O. Box 28047 Raleigh, NC 27611-8047

Patient Information	[1] Last Name <input type="text"/>		Attach Approved Printed Label Below		
	First <input type="text"/>	MI <input type="text"/>			
	[2] Address <input type="text"/>				
	Address <input type="text"/>				
	City <input type="text"/>				
		[3] County <input type="text"/>	State <input type="text"/>	Zip Code <input type="text"/>	
[4] Local Pt. ID <input type="text"/>	SSN <input type="text"/> - <input type="text"/> - <input type="text"/>	[5] Date of Birth (MM/DD/CCYY) <input type="text"/> / <input type="text"/> / <input type="text"/>			
[6] Medicaid Client <input type="checkbox"/> Yes If yes, enter # <input type="text"/>	<input type="checkbox"/> No <input type="text"/>	[7] Dx Code/ICD <input type="text"/>			
[8] Race (mark all that apply)		[9] Ethnicity	[10] Sex	[11] Other (mark all that apply)	
<input type="checkbox"/> White <input type="checkbox"/> American Indian/Alaska Native <input type="checkbox"/> Black <input type="checkbox"/> Native Hawaiian/Pacific Isles <input type="checkbox"/> Asian <input type="checkbox"/> Unknown		<input type="checkbox"/> Hispanic <input type="checkbox"/> Non-Hispanic <input type="checkbox"/> Unknown	<input type="checkbox"/> Male <input type="checkbox"/> Female	<input type="checkbox"/> Refugee (up to 16 years of age, see definition below) <input type="checkbox"/> Child (up to 6 years of age) <input type="checkbox"/> Prenatal <input type="checkbox"/> WIC Patient	
[12] ESSENTIAL SPECIMEN DATA		[13] EIN / Federal Tax Number			
Date Collected (MM/DD/CCYY) <input type="text"/> / <input type="text"/> / <input type="text"/> <input type="checkbox"/> Microtainer <input type="checkbox"/> Initial blood lead test <input type="checkbox"/> Venous <input type="checkbox"/> Follow-up blood lead test		<input type="text"/> - <input type="text"/> EIN / Federal Tax Number, including letter suffix (if assigned), that is registered with the State Laboratory of Public Health MUST be included for specimen to be processed. Name _____			
[14] Enter last name and NPI or ordering provider		LAB			
NPI Number <input type="text"/> Ordering Provider Last Name <input type="text"/>					
		Lab Use Only		Bar Code	
		<input type="checkbox"/> Specimen Missing <input type="checkbox"/> Submitter info not provided Unsat Code _____		<input type="text"/>	

INSTRUCTIONS

PURPOSE: To identify children up to 6 years of age with elevated blood lead levels.

PREPARATION OF SPECIMEN: Collect specimen following instructions in "SCOPE, A Guide to Services" on our website at <http://slph.ncpublichealth.com>, using recommended collection kits. Label each tube with patient's name and date of birth; refrigerate until shipped. Fill out this form and mail in appropriate mailer with the specimen to the State Laboratory of Public Health. Do not send without patient information on specimen or without a form.

PREPARATION OF FORM: Do Not Photocopy. Forms must be printed on plain white paper from our website at <http://slph.ncpublichealth.com>. For optimum accuracy, please print in capital letters and avoid contact with the edge of the boxes.

- [1] Enter patient's name, last name, first name and middle initial. Only approved labels may be used as an alternative.
- [2] Enter patient's **home** address on lines immediately below. This information is required for epidemiologic follow-up.
- [3] Enter county of residence of the patient (Health Departments use county code).
- [4] Enter patient number (SSN or other unique number).
- [5] Enter date of birth (not age).
- [6] Indicate if patient is a Medicaid client; if yes, enter Medicaid number.
- [7] Enter Diagnosis Code or ICD-9 Code number.
- [8], [9] and [10]. Indicate race, Hispanic ethnicity, and sex by checking the appropriate box. These data are for statistical purposes only.
- [11] Indicate if patient is a Refugee, Child, Prenatal or a WIC client.
- [12] Enter date the specimen is collected, Microtainer or Venous sample and Initial or Follow-up test.
- [13] Enter submitter federal tax number (EIN), including letter suffix (if assigned), that is registered with the State Laboratory of Public Health.

Refugee – person up to 16 years of age who has had to flee his/her country because of a well-founded fear of persecution for race, religion, nationality, political opinion or membership in a particular social group; most likely he/she cannot or are afraid to return to his/her homeland. Refugee is a legal and documented immigration status in the United States.

DISPOSITION: This form may be destroyed in accordance with Standard 5, Patient Clinical Records, of the Records Disposition Schedule published by the N.C. Division of Archives and History.

Appendix E. Educational Materials

Lead Poisoning Prevention and Healthy Homes Outreach Materials

NORTH CAROLINA RESOURCES

Are You Pregnant? Protect Your Baby from Lead Poisoning

This low literacy brochure provides information on protecting pregnant women and their infant children from lead exposure. The brochure is available in English and Spanish.

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Pregnancy_July-2017_English_for-web.pdf

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Pregnancy_July-2017_Spanish_for-web.pdf

Cleaning Up Take-Home Lead Dust in your Home and Car

This low literacy fact sheet provides information and images that show effective ways for cleaning up lead-based paint dust. The fact sheet is available in English and Spanish.

https://nchealthyhomes.com/files/2018/07/Cleaning-up-lead_final_English_07202018.pdf

https://nchealthyhomes.com/files/2018/07/Cleaning-up-lead_final_Spanish_07202018.pdf

Healthy Homes and Lead Exposure (web page), UNC CEHS Community Outreach and Engagement Core

This web page was developed by the Community Outreach and Engagement Core in the UNC Center for Environmental Health and Susceptibility, showcasing its collaboration with Center researchers, as well as national and state health and housing agencies to develop educational materials that inform professionals and the public about hazards in homes.

<https://sph.unc.edu/cehs/outreach-and-engagement/healthy-homes/>

Keeping Lead at Work and Preventing Take-Home Lead Exposure

Lead dust can be carried home on a person's clothes, shoes, skin and hair after work or hobbies, and families, vehicles, and home interiors could be exposed. This low literacy fact sheet provides information and images that show effective ways for preventing that exposure while at work and when coming home after work.

https://nchealthyhomes.com/files/2018/07/keeping-lead-at-work_final_English_07202018.pdf

https://nchealthyhomes.com/files/2018/07/keeping-lead-at-work_final_Spanish_07192018.pdf

Lead in Spices, Herbal Remedies, Ceremonial Powders, and Cosmetics

This fact sheet highlights information on some imported products that may contain high levels of lead and ways to avoid exposure. It is available in English and Spanish.

https://nchealthyhomes.com/files/2018/07/Lead-in-Spices_NCDPH_FINAL2018-0730.pdf

https://nchealthyhomes.com/files/2018/08/Lead-in-Spices-Herbal-Remedies-Ceremonial-Powders-and-Cosmetics_Spanish.pdf

Lead Poisoning Can Be Prevented: Some Do's and Don'ts

This low literacy brochure provides information on sources of lead exposure and ways that families can protect their children from it. The brochure is available in English and Spanish.

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Children_July-2017_English_for-web.pdf

https://nchealthyhomes.com/files/2017/07/Prevent-Lead-in-Children_July-2017_Spanish_for-web.pdf

Lead Sources Library

This online library provides images and descriptions of spices, herbal remedies, cosmetics and ceremonial powders that may contain lead.

<https://nchealthyhomes.com/lead-sources/>

North Carolina Healthy Homes Website

Outreach, educational, and policy materials on lead, mold and other environmental exposures affecting human health are available on this site.

<http://nchealthyhomes.com/>

Prevent Lead Poisoning: A Training for Health and Housing Professionals (online)

This 55-minute online module provides information on the primary sources of lead exposure and poisoning, testing recommendations and prevention methods.

https://nciph.sph.unc.edu/tws/HEP_CEHS1/certificate.php

NATIONAL RESOURCES

Environmental Health Sciences Research: Asthma, Lead and Mold

The National Institute of Environmental Health Sciences (NIEHS) shares environmental health sciences research and educational materials on a number of topics related to healthy homes, including asthma, lead and mold.

<https://www.niehs.nih.gov/health/topics/index.cfm>

Help Yourself to a Healthy Home

This booklet was developed by the US Department of Housing and Urban Development and other agencies to provide information on specific action steps that residents can take to remove health hazards from their homes. This booklet is available in English and Spanish.

https://www.hud.gov/sites/documents/DOC_11880.PDF

Lead (web page)

The Centers for Disease Control and Prevention shares information on lead surveillance, policy and interventions, including educational strategies and materials to prevent lead poisoning among young children and pregnant women.

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

Lead Poisoning Prevention Resources in Other States

Scan down this page to access lead poisoning prevention outreach materials developed in New York State, New York City, and Washington State Health Departments.

<http://nchealthyhomes.com/lead-poisoning/>

Learn about Healthy Housing

The National Center for Healthy Housing provides information on the healthy homes principles, healthy housing activities in each state, educational materials, and additional resources for residents and homeowners.

<https://nchh.org/information-and-evidence/learn-about-healthy-housing/>

Protect Your Family from Lead in Your Home

This pamphlet, developed by the Environmental Protection Agency (US EPA), pamphlet explains the dangers of lead in your home and how to protect your family from lead-based paint hazards. It is available in multiple languages.

<https://www.epa.gov/lead/protect-your-family-lead-your-home>

The Lead-Safe Certified Guide to Renovate Right

Federal law requires contractors that disturb painted surfaces in homes, child care facilities and schools built before 1978 to be certified and follow specific work practices to prevent lead contamination. This guide shares valuable information for residents and child care center operators who may hire contractors.

<https://nchealthyhomes.com/files/2016/11/renovaterightbrochure.pdf>

MATERIALS FOR YOUNG CHILDREN

Susie and Jerome Learn about a Healthy Home

The University of Connecticut and the Connecticut Department of Health partnered to develop an illustrated rhyming book that describes how a young girl and her family learn about the healthy homes principles and simple ways that children and adults can apply those principles in their homes. In addition to a print version of this book, the website contains an activity book, a teacher guide and an animated video of the book.

<http://www.hec.uconn.edu/programs.html>

Ethan's House Gets Healthier

This print version of a coloring book tells the story of a young boy named Ethan and how the local lead poisoning prevention team teaches him and his family about getting tested for lead and protecting themselves from lead exposure in their home.

https://www.cdc.gov/nceh/lead/coloring_book/coloring_book.pdf

Appendix F: Nutritional Material

Prelude to Nutritional Focus Article

The following *Nutrition Focus* article “Childhood Lead Poisoning and the Role of Nutrition” was written in 2002 and therefore does not reflect the 2012 CDC recommendation to begin diagnostic (venous) testing for all children who have an initial blood lead test result $\geq 5 \mu\text{g}/\text{dL}$.

However, the article’s information about the health effects of lead, sources and pathways of lead exposure in children, the role of nutrition, nutrition assessment methodology and lead poisoning prevention, education and intervention is still accurate and relevant for childhood lead poisoning prevention.

Nutrition

*for children with
special health care needs*

FOCUS

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Childhood Lead Poisoning and the Role of Nutrition

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BACKGROUND

Childhood lead poisoning is a major, preventable, environmental health problem. The persistence of lead poisoning in light of present knowledge about the sources, pathways and prevention of lead exposure, continues to challenge clinicians and public health authorities. Lead has no known physiological value and children are particularly susceptible to its toxic effects. Most poisoned children have no apparent symptoms, and consequently, many cases go undiagnosed and untreated. Recent studies suggest that even blood lead levels (BLLs) below 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$) can adversely affect children's ability to learn, and their behavior. No socioeconomic group, geographic area, racial or ethnic population is spared.

The percentage of children ages 1-5 in the United States with elevated blood lead levels has decreased from 88.2% (1976-80) to 4.4% (1991-1994) according to data from the Second and Third National Health and Nutrition Examination Surveys (NHANES). However, the Centers for Disease Control and Prevention (CDC) estimate that approximately 890,000 children in the United States have blood lead levels $\geq 10 \mu\text{g}/\text{dL}$.¹ Moreover, among U.S. children ages 1-5 who

had BLLs $\geq 20 \mu\text{g}/\text{dL}$, 83% were Medicaid enrollees, as were 60% of those with BLLs $\geq 10 \mu\text{g}/\text{dL}$.² For some states, the Medicaid burden is even greater. For example, from 1998 to 2000 in North Carolina, more than 75% of children with BLLs $\geq 10 \mu\text{g}/\text{dL}$ were Medicaid enrollees. Unfortunately, while Medicaid children have a prevalence of elevated BLLs three times that of children in the same age group who are not Medicaid enrollees, 65% of them are not screened according to recent estimates by the Government Accounting Office (GAO).³ As a result, the CDC recommended targeted screening for all high-risk children at ages one and two in 1998. An example of targeted screening is the establishment of different screening strategies for low and high-risk zip codes, based on the age of housing stock and the number of children with elevated BLLs.

Sources of lead exposure are listed in Table 1 and include lead-based paint, soil, house dust and drinking water. While lead-based paint is still the major source of exposure, the concern has shifted from children eating paint chips to ingestion of lead-contaminated dust. There have even been, through hand-to-mouth activities, docu-

Editor's Note – This edition is an update of an earlier Nutrition Focus, Lebeuf, JS and Norman, EH. Nutritional Implications of Lead Poisoning in Children. Nutrition Focus. Volume 8, #5, September/October 1993. Lead poisoning is still a health problem for children and this issue provides current information about this continuing public health issue.

mented cases of childhood lead poisoning resulting from a pet whose fur was contaminated with lead dust. Imported vinyl mini-blinds made with a lead formula have poisoned children. The growing immigrant population in the United States is a challenge for public health professionals to be aware of the cultural differences and traditional products that may put these children at high risk. For example, many household items from Mexico have been found to contain lead including ceramic bean pots and tamarind candy. Some imported traditional medicines, aphrodisiacs and other herbal preparations have also been found to contain high levels of lead.

HEALTH EFFECTS

Severe lead exposure ($\geq 70 \mu\text{g}/\text{dL}$) can cause lethargy, convulsions, coma and even death in young children. Lower levels can cause adverse effects on the kidneys, and the hematopoietic and central nervous systems. According to the CDC, even blood lead levels below $10 \mu\text{g}/\text{dL}$, which do not cause specific symptoms, are associated

with decreased intelligence and impaired neurobehavioral development. Other adverse effects begin at low levels of exposure, including decreased growth and growth velocity, decreased hearing acuity, decreased ability to maintain a steady posture and impaired synthesis of vitamin D. Lead also competes with iron for incorporation into the heme molecule and can contribute to iron-deficiency anemia. Epidemiologic studies provide ample evidence on the association between low-level lead exposure and the effects on child development.

A recent study analyzed data on 4,835 children, ages 6-16 years, from the NHANES III.⁴ The relationship between blood lead concentration and performance on tests of arithmetic, reading, nonverbal reasoning and short-term memory was assessed. The researchers found an inverse relationship between blood lead concentrations and deficits in cognitive functioning and academic achievement in children at levels below 5.0 µg/dL. Reading abilities were especially affected. Behaviorally, the study suggests that attention, judgment and decision-making abilities, visual-motor reasoning skills, and

social behavior are particularly affected. These results argue for a reduction in blood lead levels that are considered acceptable. No detectable threshold for the adverse effects of exposure was found by these researchers.

In a number of prospective studies, prenatal exposures have been associated with delayed sensory-motor and early cognitive development. However, these effects appear to diminish as children grow older, given low postnatal exposure and favorable socioeconomic conditions.⁵

Table 1
Sources and Pathways of Lead Exposure in Children

Lead-based paint: The most common source of lead exposure for young children is lead-based paint. The use of lead-based paint for homes, furniture and toys is now prohibited; however, it is still found in homes built before 1978, and homes built before 1950 can contain paint with high concentrations of lead exceeding 50% by weight.

Soil and house dust: Contaminated by deteriorated paint, leaded gasoline and industry emissions, soil containing lead is found near the foundation of homes, in industrial areas and near major roads. The phase-out of lead in gasoline mandated by the EPA was completed in 1987. Remodeling and renovation, which is done without using lead-safe work practices, can generate lead dust. Dust in deteriorated window areas is often contaminated with lead.

Ceramic ware: Imported and decorated dishes or handmade pottery can be frequent sources of lead for immigrants and others. Foods stored or served in leaded crystal or food cooked and/or stored in improperly fired ceramic dishes can contain lead.

Drinking water: Water can be contaminated by plumbing in homes with lead pipes or copper pipes soldered with lead.

Food and supplements: Some imported canned products, "natural" dietary supplements such as bone meal, and some calcium supplements such as dolomitic limestone and oyster shells, while not widely recommended for young children, can be a source of lead. Levels vary considerably from trace amounts to higher levels.

Air: Emissions from active lead smelters and other lead-related industry can be inhaled.

Occupations and hobbies: Workers may take home lead dust on their clothing or bring scrap material home from work with radiators, car batteries, dirt near freeways, paint removal, smelters and factories. Hobbies such as making stained glass, pottery, fishing weights, or jewelry; reloading or casting ammunition; and refinishing furniture are sources of lead.

Traditional medicines: Folk remedies from Latin America used to treat "empacho" (upset stomach) such as greta and azarcon (also known as Rueda, Coral, Maria Luisa, Alarcon or Liga) have been found to contain more than 90% lead by weight. Pay-loo-ah is a reddish powder used by the Hmong to treat fever and rash. Some Chinese herbal remedies and teas have also been found to contain high levels of lead. Lead has also been found in aphrodisiacs imported from India and Africa.

Cosmetics: Cosmetics used by some Indian, African and Middle Eastern immigrants such as surma and kohl contain lead.

Vinyl Products: As they age and deteriorate, imported, lead containing vinyl mini-blinds may have lead dust on their surfaces. In 1996, the Arizona and North Carolina Departments of Health first alerted the U.S. Consumer Product Safety Commission (CPSC) to the problem of lead in the imported vinyl mini-blinds. Lead was added to stabilize the plastic in imported blinds. Using electron microscopy, it was confirmed that as the blinds deteriorated from sunlight and heat, lead-containing dust formed on the surface of the blind slats, posing a potential risk to young children. Young children can ingest lead by touching the mini-blinds and then putting their hands in their mouths, mouthing the window, or mouthing the blinds themselves. In some tested blinds, the levels of lead in the dust was so high that a child ingesting dust from less than one square inch of blind a day for 15 – 30 days could result in blood levels at or above 10 µg/dL. Children's vinyl toys may be another source of lead for young children. Studies done at the University of North Carolina in Asheville have demonstrated that as some soft vinyl toys are exposed to light and to chewing they can release lead as well as cadmium, another toxic heavy metal. This was particularly true among soft vinyl toys from Asia. Highest levels of cadmium were found in toys, soft lunchboxes and rainwear that were bright yellow.⁶

RECOMMENDATIONS FROM THE CENTERS FOR DISEASE CONTROL

The CDC's level of concern remains at 10 µg/dL. Targeted screening, based on geographic areas or demographic populations of highest risk, is recommended. Some states screen by evaluating blood from a finger stick. If the level is equal to or greater than 10 µg/dL then a venous blood draw is the next step. All children receiving Medicaid are required to be tested at 12 and again at 24 months of age, or upon their first entry into the health care system at a later age. A multi-tier approach to follow-up is recommended (Table 2)¹.

Children with blood leads <10 µg/dL at 12 months of age are not considered to have an elevated exposure, however, those at risk should be rescreened at 2 years of age. Table 3 lists questions to ask parents or caregivers to determine if a child is at risk for lead exposure. Additional questions may be added to tailor the questionnaire for likely sources of exposure in different communities (e.g., questions related to industry or traditional medicines). If the answers to all questions are negative, the child is considered to be at low risk for lead exposure. If the answer to any question is positive or "I don't know," the child is considered high risk for lead exposure.

Community-wide education (primary prevention activities) is recommended when many children in an area are found to have blood lead levels ≥ 10 µg/dL. In most states, children with blood lead levels ≥10 µg/dL are medically eligible for participation in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC Program). Individual case management, including nutrition and education interventions (described below and in Table 5) and frequent retesting, is recommended for children with blood leads ≥ 15 µg/dL. In many areas, families of children with BLLs ≥10 µg/dL are offered environmental investigations.

More involved medical and environmental interventions are indicated for children with blood lead levels ≥20 µg/dL. The medical evaluation consists of a careful history and a physical examination as well as evaluation of iron status and other special diagnostic tests. A medical evaluation should be conducted whether or not symptoms are present. Environmental interventions are aimed at identifying the source of exposure

Blood Lead Level (µg/dL)	Comments
<10	A child with this Blood Lead Level (BLL) is not considered to have an elevated level of exposure. Reassess or rescreen in one year. No additional action is necessary unless exposure sources change.
10-14	The CDC considers 10 µg/dL to be a level of concern. Perform diagnostic test on venous blood within three months. If the diagnostic test is confirmatory, the child should have follow-up tests at three month intervals until the BLL is <10 µg/dL. Provide family lead education. Refer for nutrition counseling.
15-19	A child in this category should also receive a diagnostic test on venous blood within three months. If the diagnostic test is confirmatory, the child should have additional follow-up tests at three month intervals. Children with this level of exposure should receive clinical management. Parental education and nutritional counseling should be conducted. A detailed environmental history should be taken to identify any obvious sources of lead exposure.
20-44	A child with a BLL in this range should receive a confirmatory venous test within one week to one month. The higher the screening test, the more urgent the need for a diagnostic test. If the diagnostic test is confirmatory, coordination of care and clinical management should be provided. An abdominal x-ray is completed if particulate lead ingestion is suspected. Nutrition and education interventions, a medical evaluation, and frequent retesting (every 3 months) should be conducted. Environmental investigation and lead hazard control is needed for these children.
45-69	A child in this category should receive a confirmatory venous test within 48 hours. If the screening blood lead level is between 60-69 µg/dL, the child should have a venous blood lead level within 24 hours. If confirmatory, case management and clinical management should begin within 48 hours. Environmental investigation and lead hazard control should begin as soon as possible. A child in this exposure category will require chelation therapy and an abdominal x-ray is completed if particulate lead ingestion is suspected.
≥70	A child with a BLL ≥70 requires immediate hospitalization as lead poisoning at this level is a medical emergency. Confirmatory venous testing should be done as soon as possible. An abdominal x-ray is completed if particulate lead ingestion is suspected and chelation therapy should begin immediately. Case and clinical management including nutrition, education, medical and environmental interventions, must take place as soon as possible.

Information from Centers for Disease Control and Prevention. Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Offices. November 1997. Atlanta, Georgia. United States Department of Health and Human Services, Public Health Services, CDC, 1997 and Centers for Disease Control and Prevention. Managing Elevated Blood Lead Levels Among Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. March 2002

(home investigation) and reducing lead hazards (abatement or remediation). For BLLs ≥ 20 µg/dL an abdominal x-ray is recommended if particulate lead ingestion is suspected. If positive, bowel decontamination is indicated.

Chelation therapy (the administration of a drug(s) that bind with lead to remove it from the body) is recommended for children with BLLs ≥45 µg/dL.⁷ An oral chelating agent, "succimer", that can be used on an outpatient basis, was approved for use in

children with blood leads ≥ 45 $\mu\text{g}/\text{dL}$. Chelation therapy may be considered if the BLLs are ≥ 25 $\mu\text{g}/\text{dL}$ however recent studies concluded that this treatment offers limited benefits to children with BLLs < 45 $\mu\text{g}/\text{dL}$. A randomized, placebo-controlled, double blind trial of chelation therapy in 780 children with BLLs less than 45 $\mu\text{g}/\text{dL}$ was undertaken by NIEHS at the Triangle Research Institute. In an article published in the New England Journal of Medicine, the researchers reported that treatment with succimer did not lead to better scores on cognitive, neuropsychological or behavioral tests than placebo.⁸ Care must be taken to keep recently chelated children away from environmental lead hazards during outpatient chelation therapy, as this type of therapy increases internal lead mobilization and can increase the absorption of lead.

THE ROLE OF NUTRITION

Young children, particularly one- and two-year-old children, are at greatest risk for lead poisoning due to their increased mobility and hand-to-mouth activity. With greater access to lead hazards and normal “mouthing” of hands and other items, there is greater ingestion of lead. Nutrition, in its broadest application, plays an integral role in young children’s susceptibility to lead. Young children’s dietary intake and nutritional status can influence the absorption, retention and effects of lead toxicity through total food intake and lead-nutrient interactions involving iron, calcium, Vitamin C, and zinc. In turn, lead can influence nutritional status through its effect on growth in stature, iron status and vitamin D metabolism.

Ingestion and Absorption of Lead in Young Children

Lead poisoning begins with ingestion and inhalation of lead. Studies show that children absorb close to 50 percent of the lead they ingest or inhale in contrast to adults who absorb only approximately 10 percent. It is estimated that young children’s absorption rates of lead from non-food sources exceed 50 percent. Rates are closer to 40 percent when the lead source is infant formula, milk, and other beverages.⁹ Reasons for more efficient lead absorption by young children include their lower body weights and the lack of effective mechanisms adults develop for clearing lead once ingested or inhaled. Young children also have an enhanced capacity to absorb lead from the gastrointestinal tract

Table 3

Questions for Families to Assess the Risk of Exposure to Lead

Does your child:

- Receive the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) Program Services or is your child enrolled in Medicaid?
- Live in or regularly visit a house built before 1978, including home childcare centers or homes of relatives with peeling or chipped paint with recent, ongoing, or planned renovation or remodeling?
- Have a brother or sister, housemate, or playmate being followed or treated for lead poisoning (blood lead ≥ 15 $\mu\text{g}/\text{dL}$)?
- Live in or regularly visit a house that contains vinyl mini-blinds?

which is possibly due to the higher density of intestinal transport proteins during periods of growth. In turn, the effects of lead in children generally occur at lower blood lead levels than in adults. For example, the developing nervous system in children can be affected adversely at levels even below 10 $\mu\text{g}/\text{dL}$ compared to adults.

Consumption-Related Exposure to Lead

Efforts to limit exposure to lead-containing paints, gasoline, and food and beverage containers have made a tremendous impact. The U.S. Food and Drug Administration’s 1994-1996 Total Diet Studies showed that, since 1982-1984, daily intakes of lead from food dropped 96 percent in 2- to 5-year-olds (from 30 to 1.3 micrograms).¹⁰ However, the most common source of lead exposure for young children continues to be deteriorating lead-based paint chips and dust inside and outside homes, particularly those built before 1950 when paint containing as much as 50% or more lead by weight was still widely used. Children can ingest loose paint as a result of pica (compulsive eating of non-food items).

When food contains lead, it may be from the environment or from containers used for food or beverage storage. Agricultural vehicles are not required to use unleaded gaso-

line; consequently lead can be deposited on and retained by crops, particularly leafy vegetables. Lead in soil can also be taken up by plants as they grow. Lead glazes are used in making pottery and ceramicware which may be used for cooking or storage of food. Traditional pottery imported from Mexico or other countries often use glazes which may contain large amounts of lead. Foods stored in cans made with lead solder have been found to contain lead. For the last decade, lead solder in canning has been banned from use in the United States but other countries continue to use lead solder. This is particularly a problem with imported canned meats and acidic foods like tomatoes. If lead crystal is used for storing acidic beverages such as orange or tomato juice, the acid can facilitate leaching of lead into the beverage.

It is estimated that drinking water contributes 10-20% of total lead exposure in young children. Typically, lead gets into the water supply after it leaves the treatment plant or well. The source of lead in homes is most likely leaded pipe or lead-soldered plumbing despite the Environmental Protection Agency’s ban in 1988 on using lead solder and other lead-containing materials in connecting household plumbing to public water. Many older structures still have lead pipe or lead-soldered plumbing which may substantially increase the lead content of water at the tap. Also, lead solder is still widely available and may be misused.

Calcium supplements from natural sources, such as dolomitic limestone and oyster shells, while not widely recommended for young children, can be a source of lead. Levels vary considerably from trace amounts to higher levels.

As previously defined in Table 1, some traditional medicines which may contain lead may be used by immigrant families. Children who are given these powders may actually be ingesting lead, and they may develop the same symptoms that these medicines are intended to treat.

Human Milk

Lead levels in human milk are lower than would be expected based on maternal blood lead levels. Lead’s inability to attach to the fat in human milk prevents it from becoming concentrated. However the Health Resources and Services Administration recommends that women with blood lead levels of 40 $\mu\text{g}/\text{dL}$ or above not breastfeed their infants.

Nutritional Influences on Lead Absorption

There is wide individual variation in the gastrointestinal absorption of lead. Factors which impact absorption and susceptibility to lead toxicity include age, frequency of eating, quality of the diet, and nutritional status. The state of satiety affects lead absorption. When adults ingest lead on a "full stomach", about 8% of the lead is absorbed compared to about 35% when ingested after a brief fast.⁹ As previously stated, lead absorption rates are much higher in children. Absorption is further enhanced, and in many situations, exposure to lead occurs more frequently, in children who have not eaten recently. Children playing in lead-contaminated soil, eating paint chips or inhaling lead dust hours after their last meal are at significant risk. Parents and caretakers of young children should be encouraged to provide frequent meals and snacks to children at risk for lead exposure.

Nutrients: Calcium, Iron, Vitamin C, Zinc and Fat

Dietary recommendations which are typically made in an effort to help protect children from lead poisoning are still not consistently backed up with scientific evidence. These recommendations are not controversial from a nutrition point of view, and in fact, can be easily endorsed for all children regardless of their risk of lead exposure. But, care must be taken not to make assumptions about specific nutrients and their efficacy in helping prevent lead poisoning.

Animal absorption studies have demonstrated that dietary calcium can decrease gastrointestinal lead absorption. Human studies in adult and children indicate there may be a direct interaction between lead and calcium which are consumed simultaneously, suggesting possible competition for absorptive sites in the gut. Furthermore, it has been postulated that when lead interferes with normal calcium absorption, normal growth and development may be affected. But the evidence is not strong enough to demonstrate that dietary calcium can actually reduce lead toxicity.

It has been known for a long time that iron deficiency and lead toxicity frequently coexist. In the mid-1980's, the American Academy of Pediatrics, in their *Statement on Childhood Lead Poisoning*, stated that "Iron deficiency, even in the absence of anemia, appears to be the single most important predisposing factor for increased absorption of lead".¹¹ One theory for the association between iron and lead levels in the blood comes from the fact that the two are biochemically similar and symptoms of severe iron deficiency even mimic those of lead poisoning including lethargy, inattentiveness and delays in cognitive development. This theory has also postulated that the absence of iron creates a nutrient deficit in the body, which responds by grabbing more of the lead that is ingested by the child, or hanging onto the lead more strongly once it is in the body. However, as in the case of calcium, more recent studies indicate there is no strong evidence that increasing dietary iron will definitely decrease lead absorption and lead toxicity.

Zinc status influences lead absorption at the gastrointestinal level. Animal research has demonstrated an increase in tissue lead levels and lead toxicity as dietary zinc content decreases. There is some clinical data associating zinc status and elevated lead levels in children. For proper brain development in children, the body relies on the trace mineral zinc to help regulate genes that coordinate brain cell growth. In findings that shed new light on understanding how lead affects the developing brains of children, researchers believe

that when lead is introduced into the body in sufficient quantities, it displaces zinc and ultimately disrupts brain cell growth.

Although several animal studies suggest a protective relationship between blood lead concentrations and ascorbic acid, there are no conclusive results regarding the beneficial effect of vitamin C on lead concentrations in human studies. Serum ascorbic acid concentrations were inversely associated with the prevalence of elevated blood lead concentrations, but there was no significant relationship between dietary vitamin C intake and blood lead

Table 4
NUTRITION ASSESSMENT FOR CHILDREN
WITH ELEVATED BLOOD LEAD LEVELS

Anthropometric

Assess growth parameters including:

- weight-for-age
- appropriate rate of weight gain if indicated
- length/height-for-age
- weight-for-length for infants and children < 2 years, or BMI children \geq 2 years of age
- calculate mid-parental height if height-for-age is below the 5th percentile

Biochemical

- Assess test results for blood lead level
- Review tests for iron deficiency

Clinical

- determine nutritional implications of medical management of lead toxicity

Dietary

Assess dietary intake for:

- adequate food supply
- number of meals and snacks eaten on a typical day
- water supply and usage patterns for infant formula, beverages and foods
- adequacy of calcium iron, and zinc, and vitamin C intake
- food storage techniques
- use of imported canned foods/candy
- use of traditional medicines that might contain lead

Ecosocial

- Review findings from environmental assessment if available
- Ask questions regarding pica or excessive mouthing behaviors
- Assess home sanitation:
 - meal preparation area
 - hand washing practices
 - washing pacifiers/bottle nipples/toys

concentrations. There is however enough evidence to support the beneficial effect vitamin C has on iron absorption thereby improving iron status and helping prevent lead absorption.¹²

Fat Intake

There is limited scientific evidence showing that increased intakes of dietary fat increase absorption and retention of lead. Dietary fat intake was found to enhance the absorption of lead in animal studies but these results have not been replicated in children.

PREVENTION, EDUCATION AND INTERVENTION

Primary Prevention

Public health departments and health care practitioners should, at a minimum, support, oversee, and monitor the activities necessary to prevent childhood lead poisoning. Primary prevention ac-

tivities include public education and providing anticipatory guidance to families about the causes of lead poisoning.

Participation of young children in targeted public health programs, such as the WIC Program, has helped lead poisoning prevention and detection efforts. Nutrition education, referrals and supplemental foods are the cornerstones of helping families; and foods provided by WIC are nutritious and include nutrients previously mentioned. A study published in 1998 used data from the 1989-1991 Continuing Survey of Food Intakes by Individuals (CSFII) conducted by the U.S. Department of Agriculture. The study found that the WIC Program had major effects in improving nutrient intakes among low-income preschoolers.¹³ WIC had significantly positive effects on preschoolers' intakes of ten nutrients including three of the four nutrients most frequently deficient in the diet of preschoolers—iron, zinc, and vitamin E. The researchers noted that iron deficiency is the single most prevalent nutritional deficiency in the United States and that anemia rates are still high among young low-income children. They also noted that previous studies indicate zinc deficiencies may be related to growth retardation.

Table 5
Preventing Lead Poisoning in Young Children - Guidelines for Education, Nutrition and Hygiene

Recommendation	Rationale
Offer young children breakfast and other meals and snacks at regular, well spaced intervals, such as every 2-3 hours.	Lead is more readily absorbed when the body is in a fasting state, such as when the body has been without food for an extended period (e.g. after a night's sleep). Children exposed to lead absorb less when they have recently consumed food.
Ensure that young children's daily intake of calcium, iron, Vitamin C, and zinc meet recommendations.	Children with diets adequate in these nutrients may absorb and retain less lead than children with inadequate intakes.
Use fully-flushed cold water for drinking and food preparation.	Lead or lead-soldered pipes leach lead into the water supply. Hot tap water leaches more lead from pipes and pipe solder than cold water. Water that has been sitting in the pipes for several hours or overnight has higher lead levels than water from flushed pipes. If the cold water hasn't been used for more than two hours, run it for 30-60 seconds before drinking it or using it for cooking.
Store food and beverages in glass, plastic or other lead-free containers	Lead soldered cans (used sometimes for imported foods), improperly glazed ceramic pottery, and lead crystal can contribute to a child's overall lead level. Food stored in or regularly consumed from leaded containers may contain significant amounts of lead.
Avoid use of traditional medicines which have been found to contain lead, such as: azarcon, greta, payloo-ah	Traditional medicines may contain significant amounts of lead and cause the same symptoms for which they are taken in addition to contributing to elevated lead exposure
Be aware of and limit opportunities for pica. Also keep children from chewing on or licking anything painted like windowsills.	Pica, or the consumption of non-food items such as paint chips or lead-contaminated soil, is the leading cause of lead poisoning in young children. Children may ingest lead from places which have been painted with lead-based paint.
Wash the child's hands and face before every meal and snack. Wash toys, pacifiers and cups after each time they fall on the floor or ground.	Hand and face washing before eating cuts down on the possibility of lead-laden dust being transferred to the food and into the child's mouth. Washing items which go into the child's mouth will also decrease the amount of dust and dirt ingested.
Discourage "cruising" while eating meals or snacks. Food needs to be eaten at a clean table or kitchen counter under the supervision of an adult.	Food eaten "on the run" gets dropped on the floor, dragged over furniture, or placed on a window sill and then retrieved and eaten along with the potentially lead-laden dust it has collected.

Secondary Prevention

Secondary prevention activities include conducting blood lead level screenings, providing medical management when problems are identified and providing education to manage lead poisoning and prevent further lead exposure. In most of the target communities in North Carolina, for example, families of children with elevated BLLs receive a home visit, a cleaning kit and instructions on how to do specialized cleaning to remove lead dust. Clinical management of individuals with elevated BLLs includes a nutrition assessment, obtaining the ABCDE parameters: anthropometric, biochemical, clinical, dietary, eco-social. See Table 4. Within these parameters are areas which warrant special consideration when assessing the nutritional status of children exposed to lead or at high-risk for lead poisoning.

Secondary preventive measures include nutrition education and counseling aimed at:

- ensuring an intake of calcium, iron, Vitamin C, and zinc sufficient to meet daily requirements
- ensuring the young child's total dietary intake over three meals and at least two snacks
- preparing infant formula, beverages and foods with cold tap water from fully flushed pipes
- storing foods in lead-free containers
- washing hands before eating, and cleaning bottle and pacifier nipples, and toys each time they fall on the ground
- limiting opportunities to eat non-food items such as lead-contaminated soil or lead-based paint chips.

Table 5 provides additional guidelines for the prevention of lead poisoning in young children.

SUMMARY

Lead is the number one environmental pollutant affecting the health of children in the United States. The CDC guidelines were developed in response to evidence that blood lead levels even below 10 µg/dL in young children are associated with decreased intelligence, impaired neuro-behavioral development, decreased growth in stature, decreased hearing acuity, and other adverse effects. There is a growing body of evidence that levels as low as 2.5 µg/dL are associated with decreased reading skills and antisocial behavior. No lower limit or threshold has been established below which no health effects occur. It is imperative that pre-school children be tested for lead poisoning, especially at ages 1 and 2 years. Healthcare and education professionals as well as parents and caretakers of young children should be informed about the sources of lead exposure and trained in both primary and secondary lead poisoning prevention activities, especially the importance of nutrition.

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RESOURCES

1. The National Lead Information Center,

1-800-424-LEAD

www.epa.gov/lead/nlicdocs.htm

This Center provides information about lead prevention, lead poisoning, testing for lead in your home, and home repairs when lead paint is present. Information is available in English and Spanish. Written information includes:

a. Lead Poisoning and Your Children,

developed by the Environmental Protection Agency, is a colorful, attractive brochure which reviews possible sources of lead exposure and

suggests how to reduce the risk of exposure. The brochure unfolds into an 11" x 17" poster which can be displayed in a clinic, office, or school setting. The poster lists seven methods to protect children from lead poisoning. The seven methods are explained in more detail on the reverse of the poster. Single copies of the poster are available by calling the National Lead Information Center.

b. Fight Lead Poisoning with a Healthy Diet: Lead Poisoning Prevention Tips for Families

is a colorful, attractive brochure which provides parents and caretakers information on preventing lead exposure in young children. The brochure focuses on nutrition and healthy foods

and includes simple recipes. It was developed by the Environmental Protection Agency's Office of Pollution Prevention. For a copy of the brochure contact the National Lead Information Center.

c. Lead in Your Home: A Parent's Reference Guide

is a 70-page paperback book that discusses environmental lead, sources of lead in the home, how to reduce the risk of lead in your home, protecting your children, repair, remodeling, interim controls, abatement, cleaning up lead waste and resources for further information. The book is published by the Environmental Protection Agency and can be ordered by calling the National Lead Information Center.

2. The Environmental Protection Agency's

Safe Drinking Water Hotline provides information on lead hazards in your drinking water. Call the hotline at 1-800-426-4791.

3. Resources on the World Wide Web

www.epa.gov/lead for the Environmental Protection Agency Lead Program
www.cdc.gov/nceh/lead for Center for Disease Control and Prevention's lead program
www.hud.gov/offices/lead for Housing and Urban Development's lead program and activities

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Future issues of NUTRITION FOCUS

July/August - Vol 17 #4

Nutrition and Attention Deficit
Hyperactivity Disorder

CLPPP Nutrition Assessment	Potential “Red Flags”	Notes/Referrals
<u>Anthropometric</u> <ul style="list-style-type: none"> • Assess growth parameters including: <ul style="list-style-type: none"> - weight-for-age and length/height-for-age - weight-for-length for infants and young children < 24 months of age OR BMI-for-age ≥ 2 years of age - appropriate rate of weight gain if indicated 	<ul style="list-style-type: none"> • <i>Child’s weight-for-age is tracking above or below the highest or lowest growth channels or deviating from the child’s “normal”.</i> • <i>Child’s length/height-for-age is deviating from the child’s “normal”.</i> • <i>Child is failing to track their “normal” growth channel for weight-for-length or BMI-for-age percentile.</i> • <i>Child (one year or older) is gaining excessively (> 1lb in 6 months) or inadequately (< 1 lb in 6 months).</i> 	
<u>Biochemical</u> <ul style="list-style-type: none"> • Assess test results for blood lead level • Asses hemoglobin or hematocrit for iron 	<ul style="list-style-type: none"> • <i>Child’s BLL ≥ 5 ug/dL.</i> • <i>Child’s hgb/hct < 11.0 or 33%.</i> 	
<u>Clinical</u> <ul style="list-style-type: none"> • Determine nutritional implications of medical management of lead toxicity 		<i>Coordinate care with child’s health care provider.</i>
<u>Dietary</u> <ul style="list-style-type: none"> • Screen dietary intake for: <ul style="list-style-type: none"> - number of meals and snacks eaten on a typical day - adequacy of diet including sources of iron, vitamin C, calcium and zinc - water supply source and usage patterns - food storage techniques and receptacles - use of imported canned foods - use of traditional home remedies that might contain lead 	<ul style="list-style-type: none"> • <i>Child is eating < 3 meals and 2 snacks daily.</i> • <i>Child is not consuming a varied diet; refer to a nutritionist if there is a concern with getting adequate variety or sources of iron-, vitamin C-, calcium- and zinc-rich foods.</i> • <i>Tap water is not flushed before using or warm water from tap is used for food preparation or drinking.</i> • <i>Food may be exposed or stored in containers that have lead, i.e. high-acid foods such as orange juice or tomatoes are stored in lead-glazed containers.</i> • <i>Child is eating imported, canned foods or spices.</i> • <i>Child is given traditional remedies with high lead content.</i> 	
<u>Ecosocial</u> <ul style="list-style-type: none"> • Review findings from environmental assessment if available • Question regarding pica or excessive mouthing behaviors • Assess home sanitation: <ul style="list-style-type: none"> - meal preparation area - hand-washing practices - washing pacifiers/bottle nipples/toys 	<ul style="list-style-type: none"> • <i>Child is eating non-food items.</i> • <i>Child has normal (developmental stage) mouthing behaviors that may increase exposure to lead.</i> • <i>Child’s food is prepared in an area that may be exposed to lead dust.</i> • <i>Child’s hands are not routinely washed before eating.</i> • <i>Child’s toys, pacifiers and bottle nipples are not washed regularly.</i> 	
		<u>Referrals:</u> D WIC D Other: _____

Appendix G: References about Refugee Children

Refugee Children and Lead Screening Recommendations

Refugees are a special group of immigrants who are admitted into the United States because of persecution or a well-founded fear of persecution on account of race, religion, nationality, membership in a particular social group, or political opinion. These individuals enter the United States legally as a refugee pursuant to Section 207 of the Immigration and Naturalization Act. For the most part, refugees cannot return home because of the danger they would face upon returning. There are a few additional immigration statuses that fall under the refugee umbrella: (1) asylees, (2) Cuban/Haitian entrants and humanitarian parolees, (3) Amerasians, (4) certified international victims of a severe form of human trafficking, and (5) Iraqi and Afghan Special Immigrant Visa holders.

Since refugee children (1) often enter into the country after the universal blood lead testing ages of 12 and 24 months, (2) are likely to never have received prior testing, and (3) are at above-average risk for lead poisoning, CDC has special post-arrival recommendations for them. The following section includes some resources for those health care providers serving refugee children. The below links can also be accessed for more information.

Lead Screening Guidelines for Refugee Children

<http://www.cdc.gov/immigrantrefugeehealth/guidelines/lead-guidelines.html>

CDC's Lead Poisoning Prevention in Newly Arrived Refugee Children: Toolkit

http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/Refugee_Tool_Kit.htm

CDC Recommendations for Lead Poisoning Prevention in Newly Arrived Refugee Children

<http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/pdfs/cdcrecommendations.pdf>

Q&A: CDC's Recommendations for Lead Poisoning Prevention in Newly Arrived Refugee Children

<http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/pdfs/q-and-a.pdf>

**LEAD SCREENING DURING THE DOMESTIC MEDICAL
EXAMINATION FOR NEWLY ARRIVED REFUGEES**

**U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases**

Division of Global Migration and Quarantine

September 18, 2013

Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees

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Update from previous lead guidelines: *The current cutoff value that CDC currently recommends for action and reporting is blood lead level ≥ 5 mcg/dL (previously was ≥ 10 mcg/dl).*

Background

Epidemiology and Geographic Distribution

Following the phasing out of leaded gasoline and the ban on lead-based paint, the prevalence of lead poisoning, previously defined as a blood lead level (BLL) ≥ 10 mcg/dL, among children in the United States, has dramatically declined since the 1970s--decreasing from 78% from 1976-1980 to 1.6% from 1996-2002.¹ In contrast, refugee children arriving in the United States in recent years have increased average rates of BLL at their time of arrival.

For example, among 1,724 refugee children 0-72 months old arriving in Minnesota between 2004 and 2005, 4.3% had a BLL of ≥ 10 mcg/dl.² This indicates the prevalence of lead poisoning in newly arrived refugee children may be 14 times greater than that of the general US population of comparable age. Although children from all regions of the world are at risk for having elevated BLL upon entering the United States, this risk appears to vary to some degree. In an analysis of new arrival screening data from Massachusetts from the mid- to late 1990s, the prevalence of elevated BLL among newly arrived refugee children under 7 years old was 7%, 25%, 27%, 37%, and 40% among those from Northern Eurasian countries, the Near East (predominately Iraq), Africa, Asia (predominately Vietnam), and Central American/Caribbean countries, respectively. None of 33 Bosnian children born in Germany had elevated BLL. This finding suggests that birthplace and other areas lived are more important predictors of elevated lead levels than ethnicity.³ In 2009, BLL was tested in 642 Burmese children from refugee camps in Thailand before they departed for the United States. Among children ages 6 months through 14 years, 5% had elevated BLLs (≥ 10 μ g/dL). Among those under 2 years of age, the rate of elevated BLL was as high as 15%. In the younger age group, anemia with hemoglobin < 10 g/dL, exposure to lead acid car batteries, and use of traditional remedies were found to be associated with elevated BLL. Putting cosmetic products in the mouth was also a suspected contributor.⁴ In many areas of the world where refugees originate, potential lead exposures include lead-containing gasoline combustion; industrial emissions; ammunition manufacturing and use; burning of fossil fuels and waste; and lead-containing traditional remedies, foods, ceramics, and utensils.^{2,3,4}

In addition, refugee children are at above average risk for lead poisoning from ongoing exposures once in the United States since they often settle into high-risk areas with older housing. Ongoing lead exposure among refugee children within the United States has been well documented. Anywhere from 6-29% of children who have normal BLL at new arrival screening may have elevated BLLs when retested several weeks to months later, based on reports from Massachusetts and New Hampshire.^{3,5} In New Hampshire, malnutrition was fairly common among children with elevated BLL (22% had low weight for their height and 35% had low height for their age at the time of repeat testing). The median age of those with elevated BLL on repeat testing was 4.9 years (range 14 months-13 years), which is considerably older than the ages of recommended screening for most children in the United States. The most common lead exposure identified among children with elevated BLL at repeat testing was lead-based paints and lead-contaminated soil where the children had played. Of the refugee children in New Hampshire with BLLs >15 mcg/dL, 89% lived in rental homes built before 1978 when lead-based paints were still used. Furthermore, two-thirds of the parents reported witnessing their children partaking in behaviors that may increase lead exposure such as pica (craving and eating nonfood items), picking at loose paint, plaster, or putty; or chewing on painted surfaces. Investigators also noted limited parental awareness of the dangers associated with lead exposure.⁵

In addition to exposure to lead-based paints and contaminated soil, refugee children are vulnerable to other unique sources of lead exposure. A variety of foods, candies, and traditional therapies have been found to be the source of exposure for many refugee children (Table 1).

Immigrant and Refugee Populations at Risk

- Refugee children from all regions of the world, especially those from resource-poor countries, are at risk of having lead poisoning upon their arrival in the United States.
- Malnourished children may be at increased risk for lead poisoning, likely through increased intestinal lead absorption mediated by micronutrient deficiencies. The best studied micronutrient deficiency related to lead levels is iron deficiency. Iron deficient children are at increased risk of developing lead poisoning.⁶ Deficiencies in calcium and zinc may also increase a child's risk.⁷

Clinical Presentation

From 1991-2011, the value indicating elevated BLL was ≥ 10 mcg/dL. Above this value, lead is known to impair intelligence and neurodevelopment.⁸ However, more recent studies have called into question whether levels lower than 10 mcg/dL are safe. The results of one study suggest that the magnitude of the decrease in intelligent quotient (IQ) for each incremental increase in BLL is greatest among those children with levels below 10 mcg/dL.⁹ In 2011, in response to the Advisory Committee on Childhood Lead Poisoning Prevention Recommendations, CDC issued a policy statement stating that the BLL indicating high lead exposure ("reference value") will be revised every four years based on the 97.5th percentile identified in the National Health and Nutrition Survey (NHANES). *Based on these criteria, the current cutoff value that CDC currently recommends for action and reporting is ≥ 5 mcg/dL.*

At higher levels, acute symptoms of toxicity may appear. Above a level of 60 mcg/dL, individuals may experience headaches, abdominal pain, anorexia, constipation, clumsiness, agitation, and lethargy.⁹ At a level of 70 mcg/dL, children may develop severe neurological complications, including seizures, ataxia, mental status changes, coma, and death.⁷ Although such severe poisonings are now rare, the death of a two-year-old Sudanese refugee girl with a BLL of 392 mcg/dL--the first lead-poisoning-related death in the US in a 10-year period--five weeks after her arrival in the United States in 2000 underscores the unique vulnerability of refugee children to this condition.¹⁰

Evaluation and Treatment of Persons with Elevated Blood Levels

An in-depth discussion of the clinical management of elevated BLL is beyond the scope of this document. Information on case management and follow-up of elevated BLL is available from the CDC at [Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention](#).¹¹ The key recommendations from this reference, including history taking, medical management, environmental assessments, and follow-up testing, are summarized below. The new reference value does not change previous recommendations for children with blood lead levels ≥ 10 $\mu\text{g}/\text{dL}$. Further guidance for BLLs <10 can be found at www.cdc.gov/nceh/lead/acclpp.

The medical and environmental exposure history can give clues to potential lead exposure (Table 2), which should be assessed in a culturally sensitive manner. If no lead sources can be identified in children with lead poisoning, clinicians should consider checking BLLs in other family members. If other family members of various ages have

elevated levels, shared source exposures, such as ceramicware, spices, foods, or remedies, may be present.^{12,13,14,15} (Table 1)

Appropriate management of children with confirmed (venous) elevated BLLs is based on the extent of the elevation. Continued follow-up testing is mandatory for all children with documented elevated venous BLLs, in addition to all refugee children aged 6 months-6 years, regardless of their initial level.

Recommendations for Post-Arrival Lead Screening

1. Check BLL of all refugee children **6 months–16 years of age** upon their arrival in the United States (generally within 90 days, preferably within 30 days of arrival).
2. Within 3–6 months post-resettlement, a follow-up blood lead test should be conducted on all refugee children aged **6 months–6 years of age**, regardless of the initial screening BLL result.
3. Within 90 days of their arrival in the United States, children aged **6 months–6 years of age** should also undergo nutritional assessment and testing for hemoglobin or hematocrit level with one or more of the following: mean corpuscular volume (MCV) with the red cell distribution width (RDW), ferritin, transferrin saturation, or reticulocyte hemoglobin content. A routine complete blood count with differential is recommended for all refugees following their arrival in the United States, and these red cell parameters are included in this testing.
4. Provide daily pediatric multivitamins with iron to all refugee children aged **6 months–6 years of age**.

Sources of Additional Information

CDC Lead homepage

CDC Lead Exposure Among Refugee Children fact sheet

CDC Lead Poisoning Prevention in Newly Arrived Refugee Children: Tool Kit
(This educational kit has modules intended for both refugee resettlement workers and medical providers. CD-ROM copies can be obtained by calling 1-800-CDC-INFO)

Centers for Disease Control and Prevention (CDC). Elevated blood lead levels in refugee children--New Hampshire, 2003-2004. *MMWR Morb Mortal Wkly Rep.* 2005;54(02);42-46.

Table 1. Examples of culture-specific exposures associated with elevated blood-lead levels in children.

Exposure	Area of origin	Reported uses	Description
Pay-loo-ah	Southeast Asia	Treatment of fever and rash	Orange-red colored powder. Administered by itself or mixed in tea
Daw tway gaw mo dah	Burmese traditional remedy	General infant remedy (multi-symptom)	Brown pellets
Greta	Mexico	Treatment of digestive problems	Yellow-orange colored powder. Administered with oil, milk, sugar, or tea. Sometimes it is added to baby bottles and tortilla dough
Azarcon	Mexico	Treatment of digestive problems	Bright orange powder. Administered similarly to greta
Litargirio	Dominican Republic	Deodorant/antiperspirant; treatment of burns and fungal infections of the feet	Yellow or peach-colored powder
Surma	India	Improve eyesight	Black powder administered to inner lower eyelid
Unidentified ayurvedic	Tibet	Treatment for slow development	Small gray-brown colored balls administered several times a day
Tiro (also known as tozali and kwalli)	Nigeria	Eye cosmetic; improve vision; ward off "evil-eye"	Fine powder
Lozeena	Iraq	Added to foods for flavor, particularly rice and meat dishes	Bright orange spice

Tamarind	Mexico	As a key ingredient in lollipops, fruit rolls, candied jams	'Bolirindo' lollipops by Dulmex are soft and are dark brown in color. Candied jams are typically packaged in ceramic jars
Lead-glazed ceramics	Often made in Latin America	Provides a glaze for vessels and helps ceramics hold water. Often found on bean pots and water jugs.	Shiny coating on vessels
Make-up and beauty products	Multiple cultures	Enhance beauty	Many types

Table 2. Questions on history that may reveal a child's exposure to lead

- Medical history
 - Does the child have symptoms of lead toxicity?
 - Is there a history of pica?
 - Are there known previous exposures or documented elevated blood lead levels (BLL's)?
 - Is there a family history of siblings with elevated BLL's?
 - Is there anything concerning upon thorough review of the child's developmental history?
- Environmental exposures
 - Paint, soil, and metal
 - What is the age and condition of the residence?
 - Does the child chew or eat peeling paint on woodwork, furniture, or toys?
 - How long has the child lived in this residence?
 - When was the house built?
 - Were recent renovations or repairs done in the home or immediate area?
 - Inquire about other areas where the child spends significant amounts of time (day care, schools, etc.).
 - Do the child's outdoor play areas contain bare soil?
 - Does the home contain mini-blinds made overseas and purchased before 1997?
 -
 - Relevant behavioral characteristics of the child
 - To what degree does the child exhibit hand-to-mouth activity, or pica?
 - Are the child's hands washed before meals and snacks?
 - Exposures to and behaviors of household members
 - What are the caregiver's occupations?

- What are the occupational and hobby history of adults with whom the child spends time (e.g., fishing, ceramic work, stained glass work, hunting)?
- Are there potential cultural exposures as discussed in Table 1 (e.g., imported foods, cosmetics, folk remedies)?
- Are painted materials or unusual materials burned in the household fireplace?
- Is food prepared or stored in imported pottery or metal vessels?

Adapted from Centers for Disease Control and Prevention's Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. Available at: http://www.cdc.gov/nceh/lead/casemanagement/casemanage_chap3.htm. Accessed May 13, 2013.

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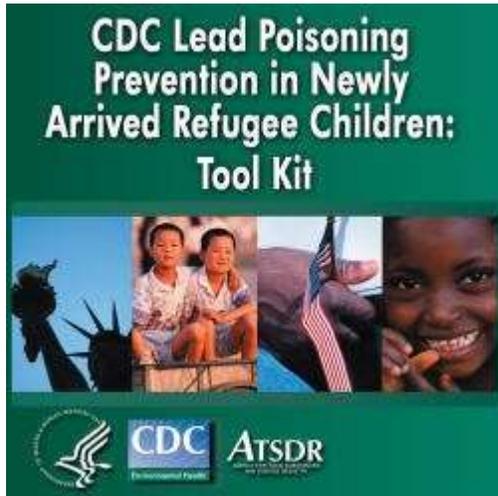
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Lead Poisoning Prevention in Newly Arrived Refugee Children: Tool Kit

http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/refugee_tool_kit.htm



[Click to download complete tool kit\[ZIP - 28.2 MB\]](#)

<http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/toolkit.zip>

Introduction to the Tool Kit

The Centers for Disease Control and Prevention's (CDC) Lead Poisoning Prevention Program in conjunction with the Office of Refugee Resettlement developed the Lead Poisoning Prevention in Newly Arrived Refugee Children tool kit in response to the increasing number of refugee children entering in the United States and subsequently developing elevated blood lead levels.

CD-ROMs of the tool kit are available by calling 1-800-CDC-INFO.

Background

On April 21, 2000, a 2-year-old Sudanese refugee girl became the first child in the United States known to have died from lead poisoning in 10 years. Her exposure occurred in the United States and was caused by lead paint in the home.

Beginning in May 2004, after the resettlement of 242 refugee children, predominately from Africa, it was discovered that a significant number of the children age range from 6 months to 15 years developed elevated blood lead levels after their arrival to the United States. Most of the children were resettled to a state that had a policy to screen refugee children for lead during their initial health examination. The first blood lead screening was done within 90 days of the children's arrival; the

second screening was done 3 to 6 months after their placement in permanent residence. Most of the children had initial capillary blood lead levels <10 micrograms per deciliter, which supports the hypothesis that exposure occurred after arrival to the United States.

Environmental investigations revealed moderate lead hazards in the residence and some contamination in soil in play areas frequented by the children. The children showed evidence of extreme chronic malnutrition and other moderate to severe health conditions.

Lead poisoning continues to be a reoccurring problem for refugee children resettled in the United States. Although little is known about lead exposure in their country of origin, data collected and research supports that most of the children are poisoned after their resettlement to the United States.

Recommendations

Primary Prevention of Elevated Blood Lead Levels

Ideally all children would live in lead-safe housing, especially those whose nutritional status and lack of knowledge about the dangers of lead place them at great risk for lead poisoning. However, we recommend the following to reduce the risk of lead exposure in refugee children:

Identification of Children with Elevated Blood Lead Levels

1. Blood lead level testing of all refugee children 6 months to 16 years old at entry to the United States.
2. Repeat blood lead level testing of all refugee children 6 months to 6 years old 3 to 6 months after refugee children are placed in permanent residences and older children, if warranted, regardless of initial test results.

Early Postarrival Evaluation and Therapy

1. Upon U.S. arrival, all refugee children should have nutritional evaluations performed, and should be provided with appropriate nutritional and vitamin supplements as indicated.
2. Evaluate the value of iron supplementation among refugee children.

Health Education/Outreach

1. CDC and its state and local partners should develop health education and outreach activities that are culturally appropriate and sensitive to the target population.

2. CDC and its state and local partners should develop training and education modules for [health care providers](#), [refugee and resettlement case workers](#), and partner agencies (e.g., WIC) on the following:
 - Effects of lead poisoning among children.
 - Lead sources in children's environments and ways to reduce the risk of exposure.
 - Nutritional and developmental interventions that can mitigate the effects of lead exposure.
 - Ways to provide comprehensive services to children with elevated blood lead levels.

Further details are available at: [CDC Recommendations for Lead Poisoning Prevention in Newly Arrived Refugee Children](#)[PDF – 454 KB]
(<http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/pdfs/cdcrecommendations.pdf>)

Contents of the Tool Kit

The tool kit is divided into three sections.

1. Refugee Resettlement Worker Module

Direct download: [PowerPoint Presentation](#)[PPT - 11.6 MB]

(http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/powerpoint_files/refugeechildren.ppt)

and [Presentation Notes](#)[DOC - 82 KB]

(http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/word_documents/refugee_resettlement_worker_module_text.doc)

Purpose: This self-guided module provides information about the importance of identifying and determining possible lead hazards in the homes of newly arrived refugee children, assuring blood lead medical services to these children, and educating the refugee population on lead poisoning prevention.

Intended Audience: This module was developed for refugee coordinators, refugee health coordinators, state and local health departments, and additional organizations involved with the well-being and resettlement of refugees.

2. Medical Provider Module

Direct download: [PowerPoint Presentation](#)[PPT - 14.1 MB]

(http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/powerpoint_files/medicalservice.ppt)

and [Presentation Notes](#)[DOC - 66 KB]

(http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/word_documents/medical_provider_module_text.doc)

Purpose: This self-guided module provides information about CDC's recommendation for identifying children with elevated blood lead levels and early post-arrival medical evaluation and therapy.

Intended Audience: This module was developed for those involved with direct medical services to refugees.

3. [Resources\(http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/rtk_resources.htm\)](http://www.cdc.gov/nceh/lead/publications/refugeetoolkit/rtk_resources.htm)

Purpose: This section includes resources for refugee resettlement workers and medical providers such as frequently asked questions about CDC's recommendations for lead poisoning prevention in newly arrived refugee children, fact sheets, training materials, links to childhood lead poisoning prevention organizations, and more.

Intended Audience: These resources were collected to assist anyone interested in learning more about the issue of lead poisoning among newly arrived refugee children.

Evaluation

We would like to receive feedback from you on the usefulness of this tool kit as it applies to your job.

We would also like to know what we can do to enhance this product and that of future tool kits.

Please email leadinfo@cdc.gov and let us know.

Contact Us:

- Centers for Disease Control and Prevention
 - 1600 Clifton Rd, Atlanta, GA 30333
 - 800-CDC-INFO (800-232-4636), TTY: 888-232-6348
 - [Email CDC-INFO](mailto:leadinfo@cdc.gov)

Appendix H: Lead and Pregnancy Resources

Lead and Pregnancy Risk Questionnaire

Answer each question by checking the small "YES," "NO," or "UNSURE" box.

If there is at least one "yes" or "unsure" box checked off in questions 1-4 or 6-8 OR if both 5a and 5b are marked "yes or "unsure," the patient should have a blood lead test and, upon results, be subsequently managed according to CDC guidelines based on test results.

1. Last Name	First Name	MI
2. Patient Number		
3. Date of Birth (MM/DD/YYYY)	Month	Day
		Year
4. Race <input type="checkbox"/> American Indian or Alaska Native <input type="checkbox"/> Asian <input type="checkbox"/> Black/African American <input type="checkbox"/> Native Hawaiian/Other Pacific Islander <input type="checkbox"/> Unknown <input type="checkbox"/> White		
5. Ethnic Origin <input type="checkbox"/> Hispanic Cuban <input type="checkbox"/> Hispanic Mexican American <input type="checkbox"/> Hispanic Other <input type="checkbox"/> Hispanic Puerto Rican <input type="checkbox"/> Not Hispanic/Latino <input type="checkbox"/> Unreported		
6. Gender <input type="checkbox"/> Female <input type="checkbox"/> Male		
7. County of Residence		

1. Have you ever had a high blood lead level?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
2. Have you spent any time outside of the United States in the past 12 months? If yes: Where?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
3. Do you use pottery, remedies, spices, foods, candies or make-up that are not sold in a regular drug store or are homemade, but are sent to you from another country?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
4. Sometimes pregnant women have the urge to eat nonfood items such as clay, soil, plaster, paint chips, or crushed pottery. Do you ever eat any of these things—even accidentally?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
5. If answer is "yes" or "unsure" to 5a; please answer 5b. If answer is "no" to 5a; please skip to Question 6. a) Was your home built before 1978? b) This past year, have there been any renovations in your home that involved sanding or scraping?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
6. Do you or others in your household have a job or a hobby that involves possible lead exposure, such as home renovation or working with stained glass, ceramics, jewelry, auto repair, battery manufacturing, or firearms (bullets, projectiles, firing ranges)?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
7. Based on the results of a laboratory test, have you been told there's lead in your home's water?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>
8. Have any of your children had an elevated blood lead level (>5 µg/dL)?	YES <input type="checkbox"/>	NO <input type="checkbox"/>	UNSURE <input type="checkbox"/>

Lead and Pregnancy Risk Questionnaire Instructions

Purpose: To assess and document past and present risk factors for lead exposure that may impact pregnancy.

Instructions: This form can be self-administered by the patient or verbally-administered by staff. Instruct the patient or staff to check off the responses of either “yes,” “no,” or “unsure” for each question. Regardless of who completes the form, it must be reviewed by staff to determine if clarifications are needed. If there is at least one “yes” or “unsure” box checked off in questions 1-4 or 6-8 OR if both 5a and 5b are marked “yes or “unsure,” the patient should have a blood lead test and, upon results, be subsequently managed according to CDC Guidelines.

The best time to conduct this questionnaire is during the initial new obstetric intake. If a blood draw is needed, it should be conducted during the time of initial obstetric labs. However, this questionnaire can be administered any time during the pregnancy.

The CDC Guidelines can be accessed at
www.cdc.gov/nceh/lead/publications/LeadandPregnancy2010.pdf.

Disposition: This form is to be retained in accordance with the records disposition schedule of medical records as issued by the Division of Archives and History, and the form should become part of the patient’s medical record.

Location: Go to the following link to access this form and print as needed:
<http://whb.ncpublichealth.com/provPart/forms.htm>.

Bilingual Lead and Pregnancy Risk Questionnaire

Answer each question by checking the small "YES," "NO," or "UNSURE" box.

Marque su respuesta a cada pregunta en la casilla indicada (Sí, No, o No sabe).

If there is at least one "yes" or "unsure" box checked off in questions 1-4 or 6-8 OR if both 5a and 5b are marked "yes" or "unsure," the patient should have a blood lead test and, upon results, be subsequently managed according to CDC guidelines based on test results.

1. Last Name	First Name	MI
2. Patient Number		
3. Date of Birth (MM/DD/YYYY)	Month	Day
4. Race <input type="checkbox"/> American Indian or Alaska Native <input type="checkbox"/> Asian <input type="checkbox"/> Black/African American <input type="checkbox"/> Native Hawaiian/Other Pacific Islander <input type="checkbox"/> Unknown <input type="checkbox"/> White		
5. Ethnic Origin <input type="checkbox"/> Hispanic Cuban <input type="checkbox"/> Hispanic Mexican American <input type="checkbox"/> Hispanic Other <input type="checkbox"/> Hispanic Puerto Rican <input type="checkbox"/> Not Hispanic/Latino <input type="checkbox"/> Unreported		
6. Gender <input type="checkbox"/> Female <input type="checkbox"/> Male		
7. County of Residence		

1. Have you ever had a high blood lead level? ¿Ha tenido usted alguna vez niveles de plomo altos en la sangre?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>
2. Have you spent any time outside of the United States in the past 12 months? If yes: Where? ¿Ha estado usted fuera de los Estados Unidos en los pasados 12 meses? Sí es Sí ¿Dónde?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>
3. Do you use pottery, remedies, spices, foods, candies or make-up that are not sold in a regular drug store or are homemade, but are sent to you from another country? ¿Usa usted cerámica, remedios caseros, especias, comida, dulces o maquillaje que son hechos en casa, o que no son vendidos en una farmacia regular, o son enviados de otro país?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>
4. Sometimes pregnant women have the urge to eat nonfood items such as clay, soil, plaster, paint chips, or crushed pottery. Do you ever eat any of these things—even accidentally? Algunas veces las mujeres embarazadas tienen el impulso de comer arcilla (barro), tierra, yeso, pedazos de pintura o de cerámica. ¿Ha comido usted alguna vez uno de estos, aunque sea por accidente?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>
5. If answer is "yes" or "unsure" to 5a; please answer 5b. If answer is "no" to 5a; please skip to Question 6. Si usted contestó "sí" o "no sabe" a la pregunta #5a, siga y conteste a la pregunta #5b. Si usted contestó "no" a la pregunta #5a, pase a la pregunta #6. a) Was your home built before 1978? b) This past year, have there been any renovations in your home that involved sanding or scraping? a) ¿Fue su casa construida antes de 1978? b) ¿Ha habido una remodelación en su casa donde se raspó o lijó algo?	YES a) <input type="checkbox"/> b) <input type="checkbox"/> Sí a) <input type="checkbox"/> b) <input type="checkbox"/>	NO a) <input type="checkbox"/> b) <input type="checkbox"/> No a) <input type="checkbox"/> b) <input type="checkbox"/>	UNSURE a) <input type="checkbox"/> b) <input type="checkbox"/> No sabe a) <input type="checkbox"/> b) <input type="checkbox"/>
6. Do you or others in your household have a job or a hobby that involves possible lead exposure, such as home renovation or working with stained glass, ceramics, jewelry, auto repair, battery manufacturing or firearms (projectiles, bullets or firing ranges)? ¿Usted o miembros de su familia tienen un trabajo o pasatiempo que implique la posible exposición a plomo, como son la renovación de casas o trabajos con vidrios de color, cerámica, joyería, reparación de vehículos o fabricación de baterías/pilas o armas de fuego (proyectiles, balas o campos de tiro)?	YES <input type="checkbox"/> Sí <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/> No sabe <input type="checkbox"/>

7. Based on the results of a laboratory test, have you been told there's lead in your home's water? ¿Con base en los resultados de una prueba de laboratorio, le han dicho que hay plomo en el agua de su casa?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>
8. Have any of your children had an elevated blood lead level (>5 µg/dL)? ¿Alguno de sus hijos ha tenido un nivel alto de plomo en la sangre (>5 ug/dL)?	YES <input type="checkbox"/> Sí <input type="checkbox"/>	NO <input type="checkbox"/> No <input type="checkbox"/>	UNSURE <input type="checkbox"/> No sabe <input type="checkbox"/>

Fecha _____

Bilingual Lead and Pregnancy Risk Questionnaire Instructions

- Purpose:** To assess and document past and present risk factors for lead exposure that may impact pregnancy.
- Instructions:** This form can be self-administered by the patient or verbally-administered by staff. Instruct the patient or staff to check off the responses of either “yes,” “no,” or “unsure” for each question. Regardless of who completes the form, it must be reviewed by staff to determine if clarifications are needed. If there is at least one “yes” or “unsure” box checked off in questions 1-4 or 6-8 OR if both 5a and 5b are marked “yes” or “unsure,” the patient should have a blood lead test and, upon results, be subsequently managed according to CDC Guidelines.
- The best time to conduct this questionnaire is during the initial new obstetric intake. If a blood draw is needed, it should be conducted during the time of initial obstetric labs. However, this questionnaire can be administered any time during the pregnancy.
- The CDC Guidelines can be accessed at www.cdc.gov/nceh/lead.
- Disposition:** This form is to be retained in accordance with the records disposition schedule of medical records as issued by the Division of Archives and History, and the form should become part of the patient's medical record.
- Location:** Go to the following link to access this form and print as needed:
<http://whb.ncpublichealth.com/provPart/forms.htm>.

Instrucciones para el cuestionario de riesgo de plomo durante el embarazo

- Objetivo:** Evaluar y documentar factores de riesgo pasados y presentes de la exposición al plomo que pueda afectar el embarazo.
- Instrucciones:** Este formulario puede ser auto-administrados por el paciente o verbalmente administrado por el personal. Instruir al paciente o al personal de marcar las respuestas de “sí”, “no” o “no sabe” por cada pregunta. Independientemente de que complete el formulario, éste debe ser revisado por el personal para determinar si se necesitan aclaraciones. Si usted contestó “sí” o “no sabe” a las preguntas #1 hasta e incluso la #4 o a las preguntas #6, #7, o #8 y contestó “sí” o “no sabe” en ambas preguntas #5a y #5b, el paciente necesitará un análisis de plomo en la sangre. Después de recibir los resultados, el paciente necesita consultar y darle seguimiento a los resultados con su proveedor de salud.
- El mejor momento para realizar este cuestionario es durante la cita obstétrica inicial. Si se necesita una extracción de sangre, debe llevarse a cabo al mismo tiempo que se hacen los exámenes de laboratorio obstétricos iniciales. Sin embargo, este cuestionario se puede administrar en cualquier momento durante el embarazo.
- Se pueden consultar las Directrices de los CDC en: www.cdc.gov/nceh/lead.
- Disposición:** Este formulario debe ser conservado en conformidad con el calendario de eliminación de documentos del historial clínico como se indica por la División de Archivos e Historia, y la forma debe ser parte del historial médico del paciente.
- Localización:** Vaya al siguiente enlace para acceder a este formulario e imprimir según sea necesario:
<http://whb.ncpublichealth.com/provPart/forms.htm>.

Sample Template Policy/Procedure/Protocol for Local Health Departments

Lead and Pregnancy Risk

Purpose: This policy is intended to assure that all pregnant women who reside in _____ County and seek healthcare from the _____ County Health Department, will be offered screening for lead exposure, and if appropriate, blood lead screening and be provided education on lead exposure and its potential dangers based on the 2010 Centers for Disease Control (CDC) Lead and Pregnancy Guidelines. Screening should be facilitated at the earliest contact with the patient using the *Lead and Pregnancy Risk Questionnaire (DHHS 4116E/4116S)*. The results from the questionnaire may suggest further intervention that includes venipuncture specimen collection.

Policy: The health department (HD) will ensure that this policy is adhered to with current evidenced-based recommendations by CDC on blood lead testing and follow-up care for pregnant/lactating patients with confirmed elevated blood lead levels. Lead crosses the placenta during pregnancy so maternal exposure can adversely affect both maternal/fetal well-being.

Responsible Person(s): It is the responsibility of the HD and its designated personnel to assure that all prenatal patients are screened for risk of lead exposure during the pregnancy, offered blood lead screening if appropriate, and to initiate follow-up for all confirmed “positive” blood lead test results. The designated personnel executing the initial obstetric (OB) history will assure that the patient completes or is assisted in completing the *Lead and Pregnancy Risk Questionnaire*. If the patient responds “yes” or “unsure” to any of the questions on the form, the patient will receive education on lead exposure and its impact on pregnancy.

Instructions for Testing: For any “yes” or “unsure” response to questions 1-4 or 6-8, a blood lead screening test is indicated. For Question 5, if the patient answers “yes” or “unsure” to 5(a); then the patient should answer 5(b). If the patient answers “no” to 5(a), then the patient should skip to Question 6. For Question 5, both parts 5(a) and 5(b) require “yes” or “unsure” responses to necessitate a blood lead screening test.

Procedures:

1. At the initial OB history appointment, the patient will be educated on lead poisoning prevention, with emphasis on relevant risk factors, and given an *Are You Pregnant? Protect Your Baby from Lead Poisoning* brochure. These are available in English/Spanish at <http://nchealthyhomes.com/lead-poisoning/> or call the Environmental Health Section, 919-707-5854 for orders.
2. Request the patient to complete the Lead and Pregnancy Risk Questionnaire in English (4116E) or Spanish (4116S). This form may be completed by the patient or verbally administered by staff.
3. If there is at least one “yes” or “unsure” box checked off in questions 1 - 4 or 6 - 8 **OR** if both 5(a) and 5(b) are marked “yes or “unsure,” the patient should have a blood lead test and, upon results, be subsequently managed according

4. If the patient agrees to testing, staff will facilitate the following steps for collecting a venous blood lead specimen for analysis at the NC State Laboratory of Public Health (NCSLPH).
 - a. Capillary sample results and results from samples analyzed on a point-of-care blood lead analyzer will not be accepted for prenatal referrals.
 - b. Venipuncture blood specimens are to be collected in a lavender-top tube.
 - c. Ensure that order requisition is **only for lead** and that (*Form DHHS #3707*) accompanies specimen.
 - d. Complete steps in collection that are consistent with internal laboratory processes. Assure that the specimen tube is labeled in accordance with [NCSLPH Label Format Specifications](#).
 - e. Assure that the prenatal box is checked appropriately on (*Form DHHS #3707*) and that the provider's name and NPI is on the form.
 - f. This is a cost-free service for only those patients who seek prenatal care through the health department. The specimen will be drawn at HD and analyzed at the NCSLPH.
 - g. Send all blood lead specimens to the NCSLPH for testing, regardless of the patient's payor source. NCSLPH bills Medicaid directly for the blood lead test with the patient's Medicaid # included on the requisition form. Local health departments should not generate a bill for this test. NCSLPH does not maintain the capability to bill private insurance; therefore, NCSLPH does not request private, third-party insurance data from health departments. The cost of testing specimens on non-Medicaid patients is assumed by the NCSLPH. Currently, the cost of uninsured patient testing is covered by the revenues generated. The NCSLPH will continue to assess cost recovery on an annual basis.
5. Blood lead test results will be available electronically to the provider on record, regardless of the level, via NCSLPH Clinical and Environmental Lab Results (CELR) at <https://celr.ncpublichealth.com/index>. The NCSLPH will call the provider on record if the blood lead level (BLL) result is ≥ 5.00 $\mu\text{g/dL}$.
6. Results are to be reviewed by the HD provider in a timely manner.
7. Follow-up interventions begin with BLLs ≥ 5.00 **micrograms per deciliter ($\mu\text{g/dL}$)**.
8. If the results are ≥ 5.00 $\mu\text{g/dL}$, a confirmatory venous sample must be drawn and sent to the NCSLPH for analysis. The provider may initiate a referral for a home investigation, if the patient has two consecutive venous blood lead levels ≥ 5.00 $\mu\text{g/dL}$ within a 12-month period.
9. Initiation of Referral for Home Investigation
 - a. HD provider will write an order for recommended follow-up as indicated per CDC guidance.
 - b. **If patient has 2 consecutive venous blood lead test results ≥ 5.00 $\mu\text{g/dL}$ within a 12-month period, the HD provider may initiate a referral for a home investigation.**
 - c. Fax a completed [Environmental Referral Form](#) to the North Carolina Childhood Lead Poisoning Prevention Program (NCCLPPP) using 919-841-4015.

d. For more information contact NCCLPPP at 919-707-5950.

10. Blood lead results should be shared with the patient in a timely manner with recommended follow-up care initiated per agency policy as outlined below.

BBL Results	Frequency of Follow-Up Testing	Recommended interventions according to BLL in Pregnancy
< 5 µg/dL	No confirmatory or follow-up testing necessary	<ul style="list-style-type: none"> • Educate on lead exposure sources and risk reduction
5-9 µg/dL	Conduct confirmatory testing within 1 month and follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL Recommend that the baby's pediatrician be alerted to the maternal elevated blood lead level.	Above actions in addition to: <ul style="list-style-type: none"> • Provide case management • Attempt to determine source of lead exposure (home, work, pica) • Counsel on strategies to reduce exposure • Assess for adequacy of patient's diet • Provide prenatal vitamins and nutritional guidance emphasizing adequate Calcium and Iron intake with Vitamin C to enhance absorption • For occupationally exposed patients (yes to question #6 on questionnaire); review safe work practices: hand washing, showering before going home, proper laundering of work clothes • Provide patient with the following: "Lead Facts" (2 sided) and "Lead and Your Occupation" • If required by employment, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	Conduct confirmatory testing within 1 month and follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: <ul style="list-style-type: none"> • Recommend removal from workplace lead exposure

25-44 µg/dL	Confirmatory test within 1-4 weeks and follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: <ul style="list-style-type: none"> • Advise not to breastfeed and discard breastmilk if BLL ≥ 40 µg/dL • Testing milk is not recommended
≥ 45 µg/dL	<p>Confirmatory test within 24 hours and then at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs</p> <p>Should be considered and treated as high-risk pregnancy</p> <p>Patient may require having care transferred to a high-risk obstetrical practice</p>	Above actions in addition to: <ul style="list-style-type: none"> • Consult or transfer to a provider specializing in lead poisoning therapy before considering chelation for the patient

Contacts:

Any additional questions regarding specimen collection, and/or reporting please contact Kate Koehler, Hemachemistry Unit Manager at (919) 807-8878.

For more information on lead in the home contact Health Hazards Unit, NC Division of Public Health at 919-707-5950.

For occupational health advice contact: Occupational and Environmental Epidemiology Branch, NC Division of Public Health, Raleigh, NC, 919-707-5900.

Testing of Breastfeeding Patients:

Encourage breastfeeding until BLL \geq 40 μ g/dL. Testing milk is not recommended.

Initial Venous BLL	Perform follow-up venipuncture blood specimen testing during lactation:
5-19 μ g/dL	Every 3 months, unless infant blood lead levels are rising or fail to decline
20-39 μ g/dL	Maternal BLL 2 weeks postpartum and then at 1 to 3-month intervals depending on trend in infant BLLs
\geq 40 μ g/dL	<ul style="list-style-type: none"> • Within 24 hours postpartum and then at frequent intervals depending on clinical interventions and trend in BLLs • Consultation with a clinician experienced in the management of lead poisoning is advised • Advise not to breastfeed. Breastmilk should be discarded

Quality Assurance: Compliance with this blood lead screening and follow-up policy will be assessed/assured via the agency's established quality assurance program review process for maternal health.

References:

- American Academy of Pediatrics & American College of Obstetricians and Gynecologists, *Guidelines for Perinatal Care* 8thed.
- Centers for Disease Control and Prevention, *Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women*
<https://www.cdc.gov/nceh/lead/publications/leadandpregnancy2010.pdf>
- Centers for Disease Control and Prevention, *Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials*, Appendix C.2 Capillary Blood Sampling Protocol
<https://www.cdc.gov/nceh/lead/publications/1997/pdf/c2.pdf>
- North Carolina Department of Public Health, *Maternal Health Agreement Addendum*

Educational Materials and Resources:

- Lead Facts
 - http://epi.publichealth.nc.gov/oeo/oii/docs/Lead_BloodTestingandPrevention2017.pdf
- Lead and Your Occupation
 - <http://ehs.ncpublichealth.com/hhccehb/cehu/lead/docs/LeadandYourOccupation-English-Oct13-2017.pdf>
- North Carolina Referral Resources
 - <http://nchealthyhomes.com/countyresources/>
 - https://nchealthyhomes.com/files/2017/12/PrenatalLeadInvestigationReferralForm_FINAL_Dec2017.pdf

**ENVIRONMENTAL REFERRAL TO:
The NC Childhood Lead Poisoning Prevention Program**

FAX COMPLETED FORM TO (919) 841-4015

Prenatal care providers should use this form to request a lead home investigation for a pregnant patient with two venous blood lead levels ($\geq 5 \mu\text{g/dL}$) within a 12-month period.

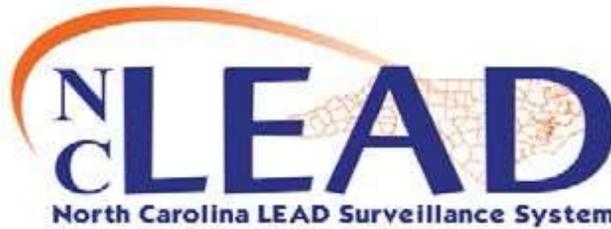
Referral Date: _____ Referred by: _____

PATIENT INFORMATION		
Last name:	First name:	DOB:
Street address: Apt.#:	City/Zip:	Language (check all that apply): English Other _____
Phone #: Alternate phone #:	Is patient pregnant? <input type="checkbox"/> Yes <input type="checkbox"/> No (Only pregnant women and children are eligible for free home lead investigations.)	Medicaid # (if any):
BLOOD LEAD TEST INFORMATION: INITIAL TEST #1		
Date collected:	Blood Lead Level ($\mu\text{g/dL}$):	Venous (only)
Analyzing laboratory name:	Laboratory address:	Phone #:
BLOOD LEAD TEST INFORMATION: DIAGNOSTIC/ CONFIRMATORY TEST #2		
Date collected:	Blood Lead Level ($\mu\text{g/dL}$):	Venous (only)
Analyzing laboratory name:	Laboratory address:	Phone #:

Blood lead samples must be sent out for analysis to a reference laboratory that uses a high complexity method of analysis.

PRENATAL CARE PROVIDER INFORMATION		
Last name:	First name:	Clinic:
Address:		City/Zip code:
Phone #:	FAX #:	Email:

Appendix I: NCLEAD



North Carolina Childhood Lead Poisoning Prevention Program **NCLEAD and Clinical follow-up**

Recently revised state guidelines call for clinical follow-up of children under the age of six who have a blood lead level (BLL) at or above a reference value based on the 97.5th percentile of the BLL distribution among children 1–5 years old in the United States (currently 5 micrograms per deciliter). These guidelines are based on recent recommendations by the Center for Disease Control and Prevention, which cite compelling evidence that low BLLs are associated with IQ deficits, attention-related behaviors, and poor academic achievement. North Carolina data indicate there may be as many as 10 times the number of children requiring clinical follow-up under the revised recommendations. NCLEAD, a web-based statewide surveillance system is used for tracking case management services for these children.

NCLEAD was implemented in July 2010 and provides real-time information to providers of clinical and environmental follow-up services. NC General Statute §130A-131.8 requires electronic submission of all blood lead test results for children under the age of six. Data from the NC State Laboratory of Public Health, LabCorp, Quest Diagnostics and Mayo feed directly into the system. Electronic data from all other laboratories are reformatted and standardized by data management staff before upload.

NCLEAD provides workflows to clinical case managers of children in need of diagnostic testing and other clinical follow-up services. The system provides the ability to capture follow-up documentation notes, assign case-specific tasks, flag cases with concerns, add attachments and share cases between jurisdictions. State and local environmental health specialists who provide environmental follow-up services also use the system. Clinical staff can access lead investigation information related to sources of lead exposure. This information can be useful to clinicians in reinforcing educational efforts to limit children's exposure to lead.

For more NC LEAD Reference Documents, please go to the Children's Environmental Health website at <http://ehs.ncpublichealth.com/hhccehb/cehu/lead/nclead.htm>



Quick Reference Guide to Clinical Print Documents

Updated 6-09-2010

The Print Documents screen is accessed by clicking on the following icon from the Dashboard toolbar



A Child Event must be loaded.

Topic	Document Name	NCLEAD Document Description	Event	How to get fields on document populated correctly	Additional info needed to fill in the template
Consent Refusal	ConsentRefusal.rtf	Consent/Refusal EBL	Child	No fields populate.	Select Tenant/ Owner Fill out Property Address Select Consent to/ Refuse
All Event Info	Event_Print.xsl	Generic Event Template	Child	This prints to a web page that you can print manually.	Prints all of information regarding Child Event. All of the BLL Results are listed, and all question pack information.
Form 3651	Form3651.rtf	Evaluation of Child with Elevated Blood Lead Level	Child	Demographic Question Package filled out Clinical Question Package: Answer the 3651 questions and they will populate the document.	You can use the pre-populated information. Save as a Word document, and enter other information manually.
Form 3958	Form3958.rtf	Risk Assessment Questionnaire	Child	Child's name Populates the Patient's Name Field.	You can use the pre-populated information. Save as a Word document, and enter other information manually.



NCLEAD: Attaching a File Or Word Document to an Event

Often, there may be a document or a file, such as a lab report, letter, or photograph that should be attached to an event. As long as the document is accessible from the user's computer, the file can be attached to an event. Attachment is found on the last line in the Event Summary Box. To attach an event to a file follow these quick steps:

1. Open the Event to which an attachment will be added (**Note:** It is not possible to attach a file to an event without first having the event loaded in the Dashboard)
2. From within the Event Summary box, on the line specifying "Attachments", click on the link that says "Add". (**Note:** "Add" will be highlighted in blue)
3. After you click "Add" a new screen will appear with a box that says "Add Attachment" On the first line of the box click "Choose File."
4. Search for the necessary document you would like to attach. (e.g., "Form 3460" or "Form 3651). Once you locate the file either double click or click "Open". You should then see the file in the top bar of the attachments box.
5. Enter a brief description of the attachment in the next box (this is a required field in NCLEAD)
6. Enter the status, type of attachment, and security level.
7. Add a note if necessary (Note: this is not a required field, but the more information you can provide, the better)
8. Click "Save" once you've entered in all the necessary information. This will bring you to the "Manage Attachments" screen.
9. Your attachment should be listed. Under "Actions", you can view, edit, or delete your attachment. If you would like to add another attachment to your event click "Add attachment" at the bottom of the screen and repeat steps 4-8.
10. Once you are finished adding attachments click "Dashboard" at the bottom of the "Manage Attachments" screen. In the "Event Summary" section it will show the number of the attachments you have attached to the event.

Appendix J: Other Resources

North Carolina Childhood Blood Lead Surveillance Data

The "**Target Population**" for children ages 1 and 2 is the sum of the number of live births from the previous two calendar years (Source: NC Vital Statistics data, State Center for Health Statistics).

"**Number Tested**" is an unduplicated count of children with blood lead samples collected during the calendar year (Source: NCLEAD, NC Childhood Blood Lead Surveillance System, Children's Environmental Health). "**Percent (%) Tested**" is the number of children tested divided by the target population and multiplied by 100.

Starting July 5, 2012, the CDC lowered its reference value to 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$). Therefore, surveillance tables for 2013 and later include a column for children tested with at least one result $\geq 5 \mu\text{g}/\text{dL}$, in addition to the column for children confirmed at 5-9 $\mu\text{g}/\text{dL}$.

"**% Tested $\geq 5 \mu\text{g}/\text{dL}$** " is the number of children tested with at least one result $\geq 5 \mu\text{g}/\text{dL}$ divided by the total number tested and multiplied by 100.

Starting in 2013, children are counted as being "tested" for lead poisoning until they are confirmed to have a lead level ≥ 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$). After a child has a "**confirmed**" lead level, the child is no longer counted as "**tested**" during subsequent years. Blood lead tests after lead level confirmation are considered "**follow-up**" test results and are not counted in the surveillance tables.

Classification is based on the lower of the two test results. Children are counted only in the column of the highest level in which they were confirmed during the calendar year; therefore, the categories "**Confirmed 5-9 $\mu\text{g}/\text{dL}$** ," "**Confirmed 10-19 $\mu\text{g}/\text{dL}$** ," and "**Confirmed $\geq 20 \mu\text{g}/\text{dL}$** " are mutually exclusive. Children are counted as having "**confirmed**" lead levels when they have two consecutive blood lead test results $\geq 5 \mu\text{g}/\text{dL}$ within a six-month period, up until December 31, 2017. The second test result must be a diagnostic test, preferably a venous sample, sent to an outside reference laboratory for analysis.

The numbers reported for North Carolina Childhood Blood Lead Surveillance Data may vary somewhat from previous reports due to ongoing improvements in data quality and receipt of previously unreported test results from laboratories.

2017 NORTH CAROLINA CHILDHOOD BLOOD LEAD SURVEILLANCE DATA, BY COUNTY

County	Ages 1 and 2 Years Tested for Lead Poisoning					Ages Birth to 6 Years			
	Target Population*	Number Tested**	Percent (%) Tested	Number $\geq 5 \mu\text{g/dL}$	% Tested $\geq 5 \mu\text{g/dL}$	Number Tested**	Confirmed 5-9	Confirmed 10-19	Confirmed ≥ 20
ALAMANCE	3,639	2,250	61.8	37	1.6	2,539	7	4	1
ALEXANDER	686	408	59.5	7	1.7	473	3		
ALLEGHANY	199	81	40.7	3	3.7	93	2		
ANSON	496	210	42.3	5	2.4	313	3		
ASHE	423	270	63.8	3	1.1	372	2		
AVERY	296	145	49.0	1	0.7	159			
BEAUFORT	917	683	74.5	12	1.8	742	8		
BERTIE	359	256	71.3	5	2.0	310	3	1	
BLADEN	684	528	77.2	5	0.9	566			
BRUNSWICK	2,022	1,181	58.4	6	0.5	1,429	2		
BUNCOMBE	5,220	3,283	62.9	38	1.2	3,686	8	4	1
BURKE	1,801	1,276	70.8	12	0.9	1,353	3	1	
CABARRUS	4,935	2,348	47.6	24	1.0	2,589	5	3	1
CALDWELL	1,622	1,159	71.5	6	0.5	1,245	2	1	
CAMDEN	180	114	63.3	1	0.9	122			
CARTERET	1,158	814	70.3	5	0.6	855	2		
CASWELL	394	251	63.7	4	1.6	274			
CATAWBA	3,418	1,919	56.1	22	1.1	2,220	6		1
CHATHAM	1,305	689	52.8	3	0.4	772	3		
CHEROKEE	479	311	64.9	3	1.0	346	1		
CHOWAN	279	152	54.5	1	0.7	167			
CLAY	184	107	58.2			132			
CLEVELAND	2,143	1,576	73.5	22	1.4	2,231	7		1
COLUMBUS	1,193	831	69.7	13	1.6	1,051	1	1	
CRAVEN	2,893	1,962	67.8	16	0.8	2,169	5		
CUMBERLAND	10,859	4,180	38.5	53	1.3	4,656	10	3	
CURRITUCK	522	189	36.2	5	2.6	213		1	
DARE	667	290	43.5	3	1.0	306	1		
DAVIDSON	3,520	2,559	72.7	26	1.0	2,746	9	1	
DAVIE	808	511	63.2	9	1.8	544	2		
DUPLIN	1,454	885	60.9	8	0.9	1,111	3	1	
DURHAM	8,577	4,160	48.5	36	0.9	4,690	10	2	
EDGECOMBE	1,205	889	73.8	23	2.6	1,070	1	1	
FORSYTH	8,835	5,669	64.2	85	1.5	6,041	23	6	1
FRANKLIN	1,408	862	61.2	9	1.0	935	2		
GASTON	5,049	2,265	44.9	29	1.3	2,505	7	2	
GATES	220	106	48.2			123			
GRAHAM	161	148	91.9	2	1.4	174			
GRANVILLE	1,151	695	60.4	9	1.3	790	4		
GREENE	410	297	72.4	8	2.7	355	2		
GUILFORD	12,353	9,260	75.0	105	1.1	10,111	31	10	2
HALIFAX	1,133	976	86.1	30	3.1	1,071	5	2	
HARNETT	3,661	1,984	54.2	33	1.7	2,334	8	4	1
HAYWOOD	1,213	867	71.5	13	1.5	908	2		
HENDERSON	2,158	1,309	60.7	13	1.0	1,514	4	1	
HERTFORD	462	357	77.3	5	1.4	418	1		
HOKE	1,891	922	48.8	11	1.2	1,035	2	2	
HYDE	88	56	63.6	1	1.8	65	1		
IREDELL	3,859	2,027	52.5	17	0.8	2,208	4	2	
JACKSON	792	610	77.0	14	2.3	649	2	2	
JOHNSTON	4,603	2,627	57.1	26	1.0	2,950	3		1

*Target Population is based on the sum of live births in 2015 and 2016.

Prepared by Children's Environmental Health
Last updated 2/27/2019

2017 NORTH CAROLINA CHILDHOOD BLOOD LEAD SURVEILLANCE DATA, BY COUNTY

County	Ages 1 and 2 Years Tested for Lead Poisoning					Ages Birth to 6 Years			
	Target Population*	Number Tested**	Percent (%) Tested	Number ≥ 5 µg/dL	% Tested ≥ 5 µg/dL	Number Tested**	Confirmed 5-9	Confirmed 10-19	Confirmed ≥ 20
JONES	173	118	68.2			132			
LEE	1,536	1,083	70.5	16	1.5	1309	3	1	
LENOIR	1,280	834	65.2	14	1.7	1055	6	1	
LINCOLN	1,600	747	46.7	11	1.5	904	3		
MACON	698	450	64.5	2	0.4	479		2	
MADISON	430	273	63.5	5	1.8	314			
MARTIN	503	306	60.8	5	1.6	405	3		
MCDOWELL	933	566	60.7	13	2.3	630	2	1	
MECKLENBURG	29,727	9,718	32.7	79	0.8	11568	26	5	1
MITCHELL	292	138	47.3	2	1.4	185			
MONTGOMERY	612	550	89.9	11	2.0	628	4	2	
MOORE	2,190	1,689	77.1	16	0.9	1798	7		
NASH	2,067	1,689	81.7	33	2.0	1900	5	2	
NEW HANOVER	4,552	3,220	70.7	41	1.3	3582	11	1	
NORTHAMPTON	377	291	77.2	10	3.4	324	2		
ONslow	8,132	3,518	43.3	39	1.1	4229	4	4	
ORANGE	2,373	1,119	47.2	14	1.3	1228	3	1	
PAMLICO	182	159	87.4	4	2.5	172	1		
PASQUOTANK	972	762	78.4	13	1.7	830	8	1	1
PENDER	1,266	847	66.9	13	1.5	999	2		
PERQUIMANS	234	165	70.5	3	1.8	184	1		
PERSON	804	456	56.7	7	1.5	522	1	1	
PITT	4,186	2,252	53.8	18	0.8	2489	4		
POLK	280	101	36.1	6	5.9	159			
RANDOLPH	3,158	2,073	65.6	29	1.4	2311	6	4	
RICHMOND	1,075	670	62.3	16	2.4	796	2	1	
ROBESON	3,546	2,308	65.1	33	1.4	2595	10	1	1
ROCKINGHAM	1,842	954	51.8	22	2.3	1112	6	3	1
ROWAN	3,253	1,807	55.5	30	1.7	2032	6	3	
RUTHERFORD	1,340	505	37.7	10	2.0	800		1	
SAMPSON	1,663	1,298	78.1	17	1.3	1461	3	1	
SCOTLAND	898	546	60.8	6	1.1	607	2	1	
STANLY	1,368	1,131	82.7	20	1.8	1202	4	3	
STOKES	791	475	60.1	7	1.5	510		1	
SURRY	1,473	907	61.6	23	2.5	1008		1	
SWAIN	388	232	59.8	3	1.3	261			
TRANSYLVANIA	537	416	77.5	3	0.7	438	1	1	
TYRRELL	90	51	56.7			55			
UNION	4,775	1,960	41.0	22	1.1	2562	5	3	1
VANCE	1,070	604	56.4	12	2.0	725	5	1	
WAKE	25,886	11,797	45.6	138	1.2	13574	32	8	3
WARREN	363	241	66.4	5	2.1	289	3		
WASHINGTON	245	159	64.9	1	0.6	188			
WATAUGA	722	502	69.5	4	0.8	570	2	1	
WAYNE	3,266	2,248	68.8	28	1.2	2599	8	5	
WILKES	1,410	962	68.2	24	2.5	1003	5		
WILSON	1,935	1,553	80.3	29	1.9	1645	11	1	2
YADKIN	778	484	62.2	6	1.2	563	3		
YANCEY	336	141	42.0	1	0.7	177	1		
STATE	241,591	132,579	54.9	1,691	1.3	150,838	421	117	20

*Target Population is based on the sum of live births in 2015 and 2016.

** 117 children tested were unable to be assigned to a county due to missing address.

State totals do not include those results missing county assignments.

Prepared by Children's Environmental Health

Last updated 2/27/2019

**NORTH CAROLINA DIVISION OF PUBLIC HEALTH
FOLLOW-UP SCHEDULE FOR DIAGNOSTIC / CONFIRMED BLOOD LEAD LEVELS
FOR CHILDREN UNDER THE AGE OF SIX**

Blood Lead Level	Response
<p align="center">Clinical and environmental follow-up is based on the <i>truncated</i> test result. Example: Actual result= 4.79; Actions based on truncated value= 4</p>	
<p>All diagnostic (i.e., confirmation) tests should be performed as soon as possible within specified time periods.</p> <ul style="list-style-type: none"> ➤ <u>Diagnostic tests</u> should be venous; however, capillary tests are accepted if a venous cannot be obtained. ➤ <u>Follow-up testing</u> can be capillary. ➤ CDC protocol for capillary sampling of blood lead should be followed. (See Resources) ➤ If diagnostic test result falls into a lower category - follow response for the lower risk category. ➤ If diagnostic or follow-up test result falls into a higher category – conduct <u>another</u> diagnostic test to confirm the higher risk category. Follow guidelines for higher risk category, after confirmation. ➤ Point of care (POC) lead analyzers (i.e., LeadCare) should NOT be used for diagnostic tests. ➤ Diagnostic tests must be sent to an outside reference laboratory. 	
<p align="center"><5 µg/dL</p>	<ul style="list-style-type: none"> • Report blood lead test result to parents and document notification • Educate family about lead sources and prevention of lead exposure <p align="center">Retest at age 2, earlier if risk of exposure increases</p>
<p align="center">5-9 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 3 months)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 5-9 µg/dL:</p> <ul style="list-style-type: none"> • Provide clinical management • Conduct nutritional assessment and refer child to the WIC Program • Take environmental history to identify lead sources (DHHS 3651 Form) • Refer to local health department to offer an environmental investigation • Test other children under the age of six in same household <p>Follow-up testing: Every 3 months until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)</p>
<p align="center">10-44 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 1 month at 10-19 µg/dL; within 1 week at 20-44 µg/dL)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 10-44 µg/dL:</p> <ul style="list-style-type: none"> • Refer to local health department for <u>required</u> environmental investigation and remediation enforcement if hazards are identified • Refer child to CDSA* Early Intervention or CC4C** as appropriate • Refer to Social Services as needed for housing or additional assistance <p>Follow-up testing:</p> <ul style="list-style-type: none"> • 10-24 µg/dL: every 1-3 months until 2 consecutive tests are <5 µg/dL • 25-44 µg/dL: every 2 weeks to 1 month until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)
<p align="center">45-69 µg/dL</p> <p align="center"><i>(Perform diagnostic test within 48 hours at 45-59 µg/dL; 24 hours at 60-69 µg/dL)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is 45-69 µg/dL:</p> <ul style="list-style-type: none"> • Consult with Carolinas Poison Center (1-800-222-1222) for advice on chelation and/or hospitalization • Consider an abdominal x-ray check for an ingested object • Alert NC CLPPP by calling 919-707-5950 <p>Follow-up testing: 45-69 µg/dL: every 2 weeks to 1 month until 2 consecutive tests are <5 µg/dL (based on the <i>truncated</i> test result)</p>
<p align="center">≥70 µg/dL</p> <p align="center"><i>(Perform emergency diagnostic test immediately)</i></p>	<p>Take same actions as above -AND- if diagnostic test result is ≥70 µg/dL:</p> <ul style="list-style-type: none"> • Hospitalize child and begin medical treatment <u>immediately</u> <p>Follow-up testing: Same as 45-69 µg/dL category</p>

*Children's Developmental Service Agency

**Care Coordination for Children

Updated 6/20/2018

Resources:

- [DHHS 3651 Form](#)
- [Agencies for Referrals by County](#)
- [Educational Materials for Families](#)
- [CDC Protocol for Capillary Sampling of Blood Lead](#)
- [CDC Protocol for Later Follow-up Testing after Blood Lead Level \(BLL\) Declining](#)



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CAPILLARY BLOOD SAMPLING PROTOCOL

The high potential for lead contamination of specimens during collection is well known,¹⁻³ and some have suggested special steps to minimize the likelihood of contamination. These include thorough scrubbing of the hand and finger with soap and then alcohol,^{4,5} using dilute nitric acid⁶⁻⁷ or using silicone or a similar barrier spray.^{3, 8-10} In three recent CDC-funded studies, results showed that using a silicone barrier spray did not reduce contamination errors in capillary blood collection protocols.¹¹⁻¹³ However, results of these studies also showed that capillary blood collection by fingerstick had very low (<10%) contamination error rates.

Various types of plastic microcollection containers (150 - 250 µL) are currently available and being used successfully to collect capillary blood from young children. Plastic containers are better than glass microhematocrit tubes, because the latter have been known to break, causing injury to laboratory personnel. The following procedure for collecting capillary blood specimens by fingerstick is recommended.

A. Materials Needed

- T Soap
- T Alcohol swabs. If a surgical or other disinfectant soap is used, alcohol swabs can be eliminated.
- T Sterile cotton balls or gauze pads
- T Examination gloves
- T Lancets. The type of lancet used is largely a matter of personal preference as long as sterility is guaranteed.
- T Microcollection containers. The laboratory

should be consulted beforehand about the type of device it will accept. Some laboratories will provide "lead-free" tubes for blood lead screening purposes.

- T Adhesive bandages.
- T Trash bags suitable for medical waste and containers for sharps. Bags containing medical waste should be clearly identified as such.
- T Storage or mailing containers if needed. If specimens require shipment, follow the U.S. P.S. or other appropriate regulations for the transport of body fluids.
- T Laboratory coat and protective glasses.

Materials used in the collection procedure that could contaminate the specimen (for example, blood containers, alcohol swabs, and barrier sprays) must be lead-free. **Before selecting equipment for use in blood collection, consult the laboratory about its requirements.** In many cases, the laboratory will recommend or supply suitable collection equipment and may precheck the equipment for lead contamination. Some instrument manufacturers also supply collection materials that are pretested for lead content.

B. Preparing for Blood Collection

All personnel who collect specimens should be well trained in and thoroughly familiar with the collection procedure and the use of universal precautions against the transmission of blood-borne pathogens. The skill of the collector will greatly influence the specimen quality. All

equipment should be within easy reach. The environment should be clean, secure, and as nonthreatening to the child as possible. Any necessary consent should be obtained before specimen collection begins, and the procedure should be explained to the child and the parent or guardian. Used materials should be immediately discarded into appropriate medical waste containers

C. Preparing the Finger for Puncture

NOTE: Puncturing the fingers of infants younger than 1 year of age is not recommended. Puncturing of the heel or toe may be more suitable for these children.¹⁴

Collection personnel should wear examination gloves whenever the potential for contact with blood exists. If the gloves are coated with powder, the powder should be rinsed off with tap water.

The child's hands should be thoroughly washed with soap and then dried with a clean, low-lint towel. Plain, unprinted, nonrecycled towels are best.¹⁵ If desired, collection personnel can use a brush to clean the finger; brushing the finger during washing can increase blood circulation in the finger.⁹ Once washed, the clean finger must not be allowed to come into contact with any surface, including the child's other fingers.

The finger to be punctured (often the middle finger) must be free of any visible infection or wound; it should be massaged to increase circulation before being punctured with the lancet. This massage can be done during or after washing.^{9, 10}

Steps for Preparing the Child's Finger

1. Select examination gloves. If necessary, rinse them to remove powder.
2. Wash the child's hands thoroughly with soap and water, and then dry them with an appropriate towel.
3. Grasp the finger that has been selected for puncture between your thumb and index finger with the palm of the child's hand facing up.
4. If not done during washing (see preceding notes), massage the fleshy portion of the finger gently.
5. Clean the ball or pad of the finger to be punctured with the alcohol swab. Dry the fingertip using the sterile gauze or cotton ball.

Puncturing the Finger

After the finger is prepared, the puncture and subsequent steps of forming a drop of blood and filling the collection container should be performed quickly and efficiently, since any delay can make collection more difficult (for example, the blood may clot or the child may resist). Several types of lancets are suitable for puncturing children's fingers. Lancets range from small manual blades and spring-loaded assemblies to disposable self-contained units. The latter are particularly attractive since the blade is automatically retracted into the holder after use, thus reducing the risk for self injury. Many devices are available with a selection of puncture depths suitable for small children or adults. Regardless of the type of lancet used, make the puncture swiftly, cleanly, and deep enough to allow for adequate blood flow.

The site of the puncture should be slightly lateral to the ball of the finger. This region is generally less calloused, which makes puncturing easier and possibly less painful.⁹ The first drop of blood contains tissue fluids that will produce inaccurate results; it should be removed with a sterile gauze or cotton ball.^{9,10}

A barrier material, such as silicone that is sprayed on the finger at this point in the process, will help a distinct "bead" of blood to form and may aid in blood collection. Blood that runs down the finger or around the fingernail is no longer suitable. Blood flows better when the punctured finger is kept lower than the level of the heart. Inadequate blood flow can be improved by gently massaging the proximal portion of the finger in a distal direction, then pressing firmly at the distal joint of the punctured finger (restricting blood flow out of the fingertip) and gently squeezing the sides of the fingertip. Avoid excessive squeezing or "milking" which will cause tissue fluid to be expressed, compromising specimen integrity.^{9,10}

Steps for Puncturing the Finger and Forming Drops of Blood

1. Grasp the finger and quickly puncture it with a sterile lancet in a position slightly lateral to the center of the fingertip.
2. Wipe off the first droplet of blood with a sterile gauze or cotton ball.
3. If blood flow is inadequate, gently massage the proximal portion of the finger and then press firmly on the distal joint of the finger.
4. A well-beaded drop of blood should form at the puncture site.
5. Do not let the blood run down the finger or

onto the fingernail.

E. Filling the Collection Container

The proper procedure for filling and capping collection containers is somewhat specific to the container used. As a general rule, contact between the skin and the container should be avoided. To prevent specimen clotting, blood must be thoroughly mixed with the anticoagulant after filling the container. Depending on the container and anticoagulant used, the agitation needed can range from gentle rocking to vigorous shaking. Some procedures call for the collection container to be rotated during filling so that anticoagulant will be distributed quickly through the sample.¹⁶ For collectors already familiar with fingerstick blood collection for other purposes (e.g., hematocrit or CBC), there is a tendency to not agitate the blood sample too strongly lest the red blood cells rupture. For blood lead tests vigorous agitation is not an issue because it is more important to prevent clotting than cell rupture.

To facilitate blood flow, many procedures call for the collection container to be held nearly horizontal, with a slight downward angle. Blood flow into the container should be uninterrupted to avoid getting air bubbles in the specimen. Most containers come with appropriate caps, and these should be applied immediately after collection. Again, consulting with the laboratory and knowing the manufacturer's recommendations are important to ensure specimen integrity and suitability for analysis.

Steps For Filling The Collection Container

1. Continuing to grasp the finger, touch the tip of the collection container to the beaded drop of blood.
2. Draw the blood into the container maintaining a continuous flow of blood.

-
3. When the container is full, cap or seal it as appropriate.
 4. Agitate the specimen to mix the anticoagulant through the blood.
 5. Check that the container is properly labeled, and place it in an appropriate storage area.
 6. Stop the bleeding, and cover the finger with an adhesive bandage. Bleeding should stop quickly. If bleeding is slow to stop, apply pressure to the puncture site with a sterile gauze or a cotton ball. If bleeding continues after 3 to 5 minutes of applying pressure, consult a physician.

References

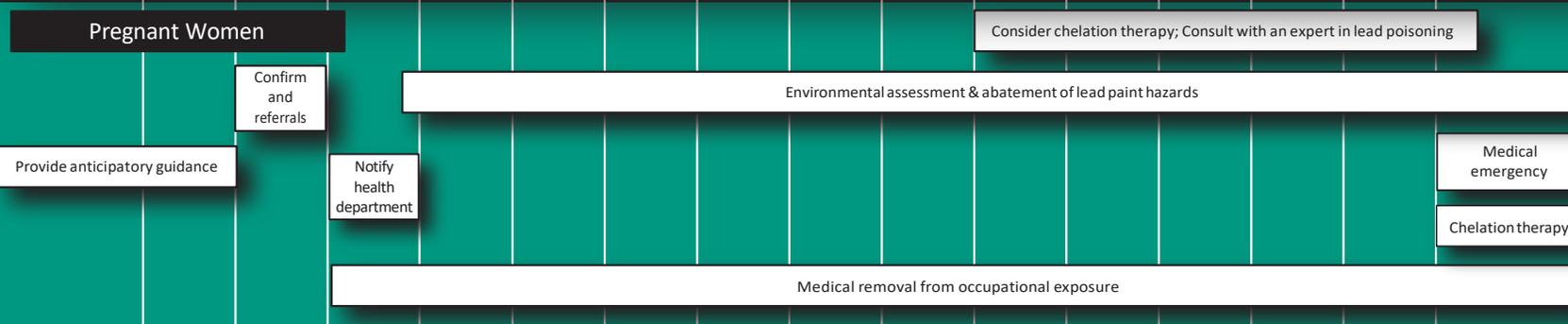
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Summary of Public Health Actions Based on Maternal and Infant Blood Lead Levels

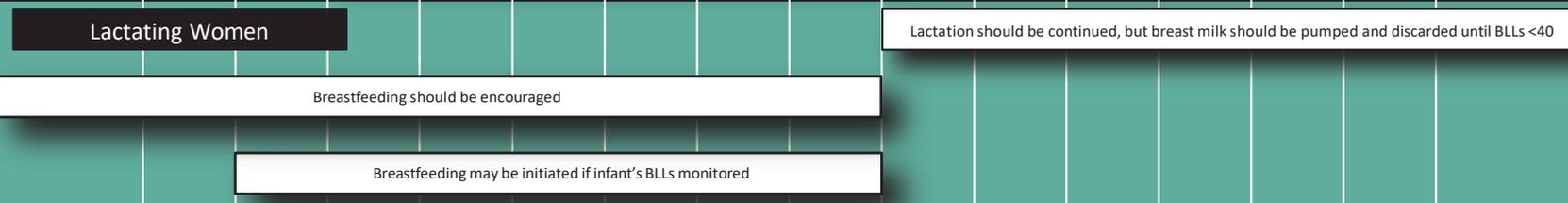
All Women of Child-Bearing Age

Provide anticipatory guidance, provide health education materials, test workers according to established guidelines, and manage elevated BLLs according to adult lead guidelines (*OSHA Medical Guidelines*)

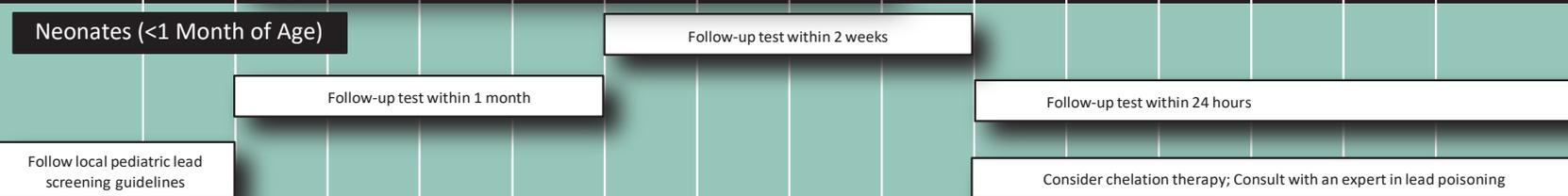
Pregnant Women



Lactating Women



Neonates (<1 Month of Age)



Infants (1 - 6 Months)



Micrograms/
Deciliter

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

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