NC Childhood Lead Testing and Follow-Up Manual

Requirements and Recommendations

Clinical Risk Assessment and Testing Methodology

Follow-Up Schedule and Education

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

Environmental Health Section • Childhood Lead Poisoning Prevention Program
https://ehs.ncpublichealth.com/hhccehb/cehu/index.htm#clppp

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North Carolina Minimum Recommendations for Lead Poisoning Prevention

DISTRIBUTION OF EDUCATIONAL MATERIALS

Educational materials regarding lead exposure should be made available to families of all children less than six years of age. Distribution of these materials should occur during all well child visits. Educational materials are available to print or share electronically at https://nchealthyhomes.com/lead-poisoning/. Contact neasha_graves@unc.edu for bulk ordering.

ASSESSMENT FOR RISK OF EXPOSURE

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

At a minimum, for children who are not required to be tested, Form 3958: **Lead Risk Assessment Questionnaire** should be administered to all children at 12 months and 24 months of age or at first contact between the ages of 25 and 72 months if the child has not been previously assessed for lead risk. Blood lead testing and risk assessment should occur during well child visits to the child's primary care provider.

Note: Local health departments should take the initiative to ensure a coordinated approach to the universal blood lead testing of children who are refugees, participate in NC Medicaid Managed Care plans, or receive WIC services. All primary care providers should be included in this process.

Questionnaires are available at http://ehs.ncpublichealth.info/forms.htm and in **Appendix D-Forms**.

TESTING METHODOLOGY

Direct blood lead measurement is the screening test of choice. Finger-stick capillary blood specimens are accepted for initial testing and follow-up testing, but it is very important to wash the child's hands with soap and water before the finger stick to minimize the risk of contamination from lead residue on skin. CDC does not recommend using a filter paper test due to risk of contamination. Contaminated capillary specimens can lead to unnecessary fear and expensive Emergency Room visits for confirmatory testing. Venous blood specimens should be collected **as soon as possible** for confirmation of all initial blood lead test results ≥3.5µg/dL; however, capillary tests are accepted if a venous cannot be obtained.

The State Laboratory of Public Health (State Lab) offers analysis of blood specimens for all children, refugees less than 16 years of age, and pregnant women receiving prenatal care at local health departments in North Carolina at no charge to the patient. Providers are encouraged to use the State Lab to expedite 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 within five business days, 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. **Diagnostic tests must be sent to an outside reference laboratory.** More information is available at EHS: CEHU: Portable Blood Lead Analyzers (ncdhhs.gov).

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. 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.

All children who meet the legal definition of 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:

An ***Elevated blood lead level*** case is defined as 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.

A ***Confirmed lead poisoning*** case is defined as 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.

Reference and background information can be found on the Centers for Disease Control website: Childhood Lead Poisoning Prevention Program Site Index | CDC.

Quick Reference Guide

Clinical Diagnostic and Follow-up Schedule

FOLLOW-UP SCHEDULE

Blood Lead Levels for Children Under the Age of Six

For each initial blood lead level ≥ 3.5 µg/dL, perform a diagnostic test ASAP. If diagnostic test result falls within a lower category, follow the steps within that category.

If diagnostic or follow up test result falls within a higher category, conduct another diagnostic test.

All diagnostic (i.e., confirmation) tests should be performed as soon as possible (ASAP), but at a minimum within specified time periods.

- *Diagnostic tests* should be venous; however, capillary tests are accepted if a venous cannot be obtained.
- Diagnostic specimens *must* be sent to an outside reference laboratory for analysis.
- Point of care (POC) blood lead analyzers (i.e., LeadCare) *CANNOT* be used for diagnostic/confirmatory tests.
- *Follow-up (post-diagnostic) testing* can be capillary.
- CDC protocol for collecting capillary specimens should be followed (www.cdc.gov/biomonitoring/pdf/Lead-Fingerstick-Poster-508.pdf).

See https://nchealthyhomes.com/clinical-lead-resources/ for a list of clinical resources.

Please contact Children's Environmental Health at (919) 609-0877 or Dph.LeadHelpdesk@dhhs.nc.gov for further assistance.

*Children's Developmental Services Agency (CDSA)
**Care Management for At-Risk Children (CMARC)

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

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INITIAL BLOOD LEAD LEVEL AND RESPONSE

< 3.50 µg/dL

- Report blood lead test results to parents and document notification
- Educate family about lead sources and prevention of lead exposure. Printable resources are available at https://nchealthyhomes.com/lead-poisoning/.
  - Retest at age 2, earlier if risk of exposure increases.

3.50 – 4.99 µg/dL — **Perform diagnostic test ASAP**

If diagnostic test result is **3.50 – 4.99 µg/dL**, take same action as previous category **AND**

- Provide clinical management
- Conduct nutritional assessment and refer child to the WIC Program
- Test other children under the age of six in same household
- Conduct follow-up testing every 3 months until 2 consecutive tests are < 3.50 µg/dL

5.00 – 9.99 µg/dL — **Perform diagnostic test ASAP**

If diagnostic test result is **5.00 – 9.99 µg/dL**, take same action as previous category **AND**

- Complete Form 3651: Exposure History of Child with Elevated Blood Lead Level to identify possible lead sources and fax a copy to Children's Environmental Health at (919) 841-4015
- Refer case to local health department to offer an environmental investigation
- Conduct follow-up testing every 3 months until 2 consecutive tests are < 3.50 µg/dL

10.00 – 44.99 µg/dL — **Perform diagnostic test ASAP (but at the latest within 1 month at 10.00 – 19.99 µg/dL and within 1 week at 20.00 – 44.99 µg/dL)**

If diagnostic test result is **10.00 – 44.99 µg/dL**, take same action as previous category **AND**

- Refer to local health department for required environmental investigation
- Refer child to CDSA* Early Intervention or CMARC**
- Refer to Social Services as needed for housing or additional assistance
- For 10.00 – 19.99 µg/dL: Conduct follow-up testing every 1-3 months until 2 consecutive tests are < 3.50 µg/dL
- For 20.00-44.99 µg/dL: Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL and consider an abdominal X-ray to check for ingested object.

45.00 – 69.99 µg/dL — **Perform diagnostic test ASAP (but at the latest within 48 hours at 45.00 - 59.99 µg/dL and within 24 hours at 60.00 - 69.99 µg/dL)**

If diagnostic test result is **45.00 – 69.99 µg/dL**, take same action as previous category **AND**

- Consult with North Carolina Poison Control (800) 222-1222 for advice on chelation and/or hospitalization
- Perform an abdominal X-ray to check for ingested object
- Alert NC CLPPP by calling (919) 609-0877
- Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL

≥ 70.00 µg/dL — **Perform emergency diagnostic test immediately**

If diagnostic test result is **≥ 70.00 µg/dL**, take same action as previous category **AND**

- Hospitalize child and begin medical treatment immediately
- Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL

FOLLOW-UP SCHEDULE FOR PREGNANCY

Initial Blood Lead Level (BLL) Results	Frequency of Testing	Recommended Interventions According to BLL in Pregnancy
< 5 µg/dL	• No diagnostic or follow-up testing necessary	• Educate on lead exposure sources and risk reduction
5-9 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL • **Alert baby's healthcare provider to maternal elevated blood lead level. Collect an umbilical cord blood sample or neonatal sample prior to discharge to establish a baseline level for the newborn. Neonatal samples can be venous or capillary (heel stick).**	Above actions in addition to: • Provide case management • Refer case to local health department to offer an environmental investigation • 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 and Pregnancy Brochure" (2 sided) and "Keeping Lead at Work and Preventing Take Home Exposure" • If appropriate for occupation, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • Recommend removal from workplace lead exposure
25-44 µg/dL	• Conduct diagnostic test within 1-4 weeks • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • **Advise not to breastfeed and discard breastmilk if BLL ≥ 40 µg/dL** • Testing milk is not recommended
≥ 45 µg/dL	• Conduct diagnostic test within 24 hours • Conduct follow-up testing at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs • Should be treated as a high-risk pregnancy. Patient may require transfer to a high-risk obstetrical practice.	Above actions in addition to: • Consult or transfer to a provider specializing in lead poisoning therapy before considering chelation for the patient

Testing Recommendations for Newly Arrived Refugees

Recommended Screening Measures	Population
Initial lead blood test	• All refugee infants and children ≤ 16 years of age • Refugee adolescents > 16 years of age if there is a high index of suspicion, or clinical signs/ symptoms of lead exposure • All pregnant and lactating women and girls*
Follow-up blood test, 3-6 months after initial testing	• All refugee infants and children ≤ 6 years of age, regardless of initial test result • Refugee children and adolescents 7-16 years of age who had BLLs ≥ 3.5 µg/dL, and for any child older than 7 years of age who has a risk factor (e.g., sibling with BLL ≥ 3.5 µg/dL, environmental exposure risk factors) regardless of initial test result • Pregnant or lactating adolescents (<18 years of age) who had BLLs ≥ 3.5 µg/dL at initial screening

*All newly arrived pregnant or breastfeeding women should be prescribed a prenatal or multivitamin with adequate iron and calcium. Referral to a health care provider with expertise in high-risk lead exposure treatment and management may be indicated for EBLLs.

See Page 1 for clinical follow-up and case management of children with blood lead levels ≥ 3.5 µg/dL.

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

How do I get the form? You can access the EHHS Form 3651 by this link, in **Appendix D-Forms**, and on the Children's Environmental Health's website (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 following link:
EH County Directory (ncdhhs.gov)

Where do I send the form? If the diagnostic test result confirms that the child has a blood lead level ≥5µg/dL, completed forms may be sent via **fax to (919) 841-4015** or mailed to:

NCDHHS, Division of Public Health
Attn: Children's Environmental Health
1934 Mail Service Center, Raleigh NC 27699-1934

NCLEAD users may also scan and attach the completed 3651 form to the Child Event in the NCLEAD surveillance system.

The form should also be sent to Environmental Health at the local health department to refer the child for environmental follow-up.

Other clinical questions? Contact Ashley Stacy-Boddapati, Nurse Consultant at (919) 609-0877 or email Dph.LeadHelpdesk@dhhs.nc.gov. Please **do not** include sensitive patient information when corresponding via email.

FAQs about Childhood Lead Poisoning Surveillance Reports (for NCLEAD users)

What is the purpose of the Surveillance Report? To let you know that these children have at least one blood lead test result ≥3.5 µg/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? NCLEAD users can print a surveillance report by clicking the "Reports" icon after logging into the NCLEAD system.

If you do not have access to NCLEAD, you can request a surveillance report via email Dph.LeadHelpdesk@dhhs.nc.gov.

When you get a report, please check the spelling of names and dates of birth information for children listed. 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 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 all blood lead test results to NC CLPPP.

Acceptable electronic file formats are any spreadsheet or database format including .xls, .xml, and .xlsx. 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:

NCDHHS, Division of Public Health
Attn: 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 in 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 at (919) 609-0877, fax to (919) 841-4015, e-mail, or mail:

NCDHHS, Division of Public Health
Attn: Children's Environmental Health
1934 Mail Service Center, Raleigh NC 27699-1934

Other questions? Please email the NC CLPPP team at Dph.LeadHelpdesk@dhhs.nc.gov. You may also reference our contact list and reach out to one of the data team members individually.

Chapter 1: Introduction

Background

Childhood lead poisoning is one of the most common environmentally caused pediatric health problems in the United States today. According to the U.S. Centers for Disease Control and Prevention (CDC), there are over half a million U.S. children ages 1-5 with blood lead levels above 3.5 micrograms per deciliter (µg/dL), the reference value at which CDC recommends public health actions be initiated.

Lead Reference Value

In 2021, the CDC lowered the blood lead reference value (BLRV) for children from **5 µg/dL to 3.5 µg/dL.** 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 is re-evaluated by the 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 high levels (≥70µg/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.

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 29 million housing units 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 ≥10µg/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. 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 these services. Blood lead testing at 1 and 2 years of age is **required** for children enrolled in NC Medicaid or the Special Supplemental 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.

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

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.

Parental occupations and hobbies. People who work with lead may bring home lead-contaminated dust on their shoes, cell phones, eyeglasses, 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.

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 (including metal jewelry) not intended for young children.

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).

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. 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 beginning in 2014.

Food and Spices. Some imported canned foods and spices have been found to contain lead. Some types of fish and products made from fish may also contain lead and mercury. More information and advisories on lead in foods can be obtained from the FDA at https://www.fda.gov/food/environmental-contaminants-food/lead-food-and-foodwares or 1-888-463-6332.

In 2023, Division of Public Health environmental health staff and the NC CLPPP team discovered that apple cinnamon fruit puree pouches were a shared source of lead exposure for several children with elevated blood lead levels. This discovery led to a recall of the products in the United States and internationally. It was determined that the cinnamon in the product contained very high levels of lead. Details of the recall and response are chronicled here: Investigation of Elevated Lead & Chromium Levels: Cinnamon Applesauce Pouches (November 2023) | FDA.

See **Appendix J - Other Resources** for an article about the NC investigation.

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.

Pottery and Cookware. 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. Antique or vintage ceramic dishware and crystal may also contain lead.

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 and Ceremonial Powders. 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 also been found in sindoor and kum kum, which are used for religious ceremonies.

See the chart at the end of this chapter for other medications and cosmetics found to contain lead. Visit the lead sources image library at https://nchealthyhomes.com/lead-sources/ *to view additional photographs of items that have been found to contain lead.*

Training Offered

Workshops offered by the NC Childhood Lead Poisoning Prevention Program are open to all health care providers, and health effects from lead exposure, blood lead testing, case management of children with elevated lead levels, and environmental remediation of lead hazards. For more information, contact Ashley Stacy-Boddapati, Nurse Consultant with the NC CLPPP at (919) 609-0877. The UNC Institute for the Environment has several archived trainings available at https://nchealthyhomes.com/resources/.

Additional reference and background information can be found
on the Centers for Disease Control website:
Childhood Lead Poisoning Prevention | CDC

Alternative Cosmetics, Food Additives, and Medicines that Contain Lead (2010)

ExposureSource	Description/Exposure Pathway
Albayalde or *albayaidle*	Used mainly by Mexicans and Central Americans to treat vomiting, colic, apathy, and lethargy.
Al Kohl (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**.
Al Murrah	Used as a remedy for colic, stomach aches and diarrhea in Saudi Arabia.
Anzroot	A remedy from the Middle East used to treat gastroenteritis.
Azarcon	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.
Ayurvedicmedicine (Tibet)	Traditional medicines that may contain lead. Some examples include: **guglu, sundari kalp, jambrulin.**
Ba-Baw-San or *Ba-Bow-Sen* (China)	Herbal medicine used to detoxify "fetal poisoning" and treat colic pain or to pacify young children.
Bali goli	A round, flat black bean which is dissolved in "gripe water" and used within Asian Indian cultures for stomachache.
Balguti Kesaria	An Ayurvedic medicine from India used to treat rickets, cough and cold, worms and teething.
Bint Al Zahab (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.
Bint Dahab (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.
Bokhoor (Kuwait)	A traditional practice of burning wood and lead sulfide to produce pleasant fumes to calm infants.
Cebagin	Used in the Middle East as a teething powder.
Chuifong tokuwan	A pill imported from Hong Kong used to treat a wide variety of ailments.
Cordyceps	Used in China as a treatment for hypertension, diabetes and bleeding.
Deshi Dewa	A fertility pill used in Asia and India.
Farouk	A teething powder from Saudi Arabia.
Ghasard	Brown powder used in Asian Indian cultures as a tonic to aid indigestion.
Greta (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.
Hai Ge Fen (Concha cyclinae sinensis)	A Chinese herbal remedy derived from crushed clam shells.
Henna	Used as a hair dye and for temporary tattoos in the Middle East and India - may contain lead.
Jin Bu Huan (China)	An herbal medicine used to relieve pain.
Kandu	A red powder from Asia and India used to treat stomachache.
Koo Sar	Red pills from China used to treat menstrual cramps.
Kushta	Used for diseases of the heart, brain, liver, and stomach and as an aphrodisiac and tonic in India and Pakistan.
Litargirio	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.
Lozeena	An orange powder used to color rice and meat that contains 7.8%-8.9% lead.
Mojhat ceremonial drink	Egyptian tea used as lactation aid.
Pay-loo-ah (Vietnam)	A red powder given to children to cure fever or rash.
Po Ying Tan (China)	An herbal medicine used to treat minor ailments in children.
Saffron supplement	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.
Santrinj (Saudi Arabia)	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."
Surma (India); Kohl; Kajal	Black powder used as an eye cosmetic and as teething powder or umbilical stump remedy.
Tibetan herbal vitamin	Used to strengthen the brain.
Traditional Saudi medicine	Orange powder prescribed by a traditional medicine practitioner for teething; also has an antidiarrheal effect.

Items in PURPLE 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: https://stacks.cdc.gov/view/cdc/147837. See https://www.cdc.gov/lead-prevention/prevention/foods-cosmetics-medicines.html for more information.

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. It is required for children covered by Medicaid.
- Children with elevated blood lead levels should be re-tested according to the clinical follow-up schedule.
- Refugee children less than 16 years of age should be tested at entry into the U.S. *and* 3-6 months after residential placement.
- Lead testing consists of an initial capillary sample (can be done with a point-of-care analyzer) followed by a diagnostic (preferably venous) sample. Ensure the child's hands are washed with soap and water to get a more accurate capillary sample. Filter paper capillary testing should not be used.
- All diagnostic samples must be sent to an outside reference laboratory for analysis, regardless of sample type. Point-of-care tests cannot be accepted as a diagnostic test.
- Offices using POC analyzers are considered laboratories and are required by law to report blood lead results for children < 6 years of age to the 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 one 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.

Health care 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** (See **Appendix D-Forms**). Page two of the form lists ZIP codes in North Carolina that data have 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

MEDICAID AND WIC PROGRAM PARTICIPANTS

All children enrolled in NC Medicaid or the Special Supplemental 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 through 72 months of age 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

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 U.S., 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 **< 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 years of age.** 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 a medical necessity.

Refugee children **younger than six 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. Refer to WIC and consider daily pediatric multivitamins with iron for refugee children less than 6 years of age. See **Appendix G-Refugee Children** 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 tragic case illustrates the need to test refugee children for lead poisoning after placement as well as at entry. You can read the full MMWR here: Fatal Pediatric Lead Poisoning --- New Hampshire, 2000 (cdc.gov).

INTERNATIONAL ADOPTEES AND IMMIGRANTS

Research has found that a large portion of immigrant children and children adopted from other countries have been exposed to lead. Risk for lead exposure varies by country of origin. Children who immigrate from other countries, including through adoption, are considered high risk for lead exposure. All immigrants and international adoptees less than six years of age require testing per our Lead Risk Assessment Questionnaire/Form 3958. Testing should follow the **NC Clinical Diagnostic and Follow-up Schedule** and occur at 12 and 24 months or upon arrival to the United States.

See https://www.cdc.gov/lead-prevention/risk-factors/refugees-immigrants.html for more information.

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 **Form 3958: Lead Risk Assessment Questionnaire (See Appendix D-Forms)**.
- ✓ **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 ≥ 3.5 µg/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=M7PFwCrOcpw

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 through the UNC Institute for the Environment at http://nchealthyhomes.com/lead-poisoning/.
To order print materials, call (919) 966-3746 or email neasha_graves@unc.edu.

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, pregnant people, and refugees up to 16 years of age. State Laboratory test results feed directly into the Division of Public Health's blood lead surveillance system, NCLEAD, removing the need for burdensome data entry by providers. Questions can be directed to the State Laboratory of Public Health at 919-807-8878.

The Medicaid program encourages all providers to utilize the State Laboratory of Public Health for blood lead tests on children (under six 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. The Clinical Laboratory Improvement Amendments (CLIA) designates facilities that use a POC lead analyzer as laboratories. 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 drawn on a separate day. POC analyzers should only be used for capillary specimens.

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 within five business days.

To arrange for reporting blood lead test results, please email Dph.LeadHelpDesk@dhhs.nc.gov.

The NC CLPPP requires that all diagnostic test specimens be analyzed at an outside reference laboratory (State Laboratory or another laboratory that uses a high complexity analysis method).
Test results obtained using a 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 are 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 applicable)

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

Key Points

- The North Carolina State Laboratory of Public Health (NCSLPH) performs blood lead analysis free of charge for all children, refugees under the age of 16, and pregnant women receiving prenatal care at local health departments in North Carolina.
- The NCSLPH will not process blood lead specimens collected on patients who are not residents of North Carolina.
- NCSLPH provides special kits (pre-paid shipping boxes and capillary tubes) for collection and shipment of specimens for all providers other than local health departments. Local health departments should use the Department of Administration Medical Courier for transport. Kits 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 hand washing step may yield an artificially elevated blood lead test result.
- Immediate shipping of specimens is recommended to ensure specimen integrity and suitability for analysis. Specimens can be stored and shipped ambient (15 to 38 ºCelsius), cold (2 to 8 ºCelsius) or frozen (-15 to -25 ºCelsius). NCSLPH must receive all specimens within 14 days of collection. Please see the NCSLPH Clinical Specimen Storage and Shipping Guide.

About Blood Lead

Childhood lead poisoning is a major preventable environmental health problem. 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 µg/dL), lead exposure is an acute condition and can have devastating health consequences, including encephalopathy, seizures, coma, and even death. New data suggest adverse effects of lead exposure in children at blood lead levels previously believed to be safe.

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

- all children
- refugees up to 16 years of age
- 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, See **Appendix H-Lead and Pregnancy Resources**) 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) and should be collected in a lavender-top blood collection tube.

The specimen must be accompanied by a completed **DHHS Form 3707** (See **Appendix H-Lead and Pregnancy Resources** or link provided below) and the "prenatal" box must be checked appropriately.

Since the CDC 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 North Carolina State Laboratory of Public Health will not process blood lead specimens collected on patients who are not residents of North Carolina. The North Carolina Childhood Lead Poisoning Prevention Program does not have jurisdiction in another state and can only offer environmental investigations to NC residents who qualify.

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 to the State Lab only.

The NCSLPH Online Supply Ordering System **must be used to order supplies**. Ordering link: https://slphreporting.dph.ncdhhs.gov/labportal/

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.dph.ncdhhs.gov/Forms/3707-Blood-Lead-Analysis.pdf and in **Appendix D-Forms** and **Appendix H-Lead and Pregnancy Resources**.

It is imperative that 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 Codes: Z 13.88; Z77.01; R78.7

B. **Collection of Finger Stick Blood Sample**
Please refer to the instructions on the next page
(also found in **Appendix J-Other Resources**).

CDC's Mission Unleaded video is also available on YouTube:
Mission Unleaded: How to test children for lead with maximum accuracy – (youtube.com)

C. **Shipment:** All samples must be labeled with TWO patient identifiers. NCSLPH must receive all specimens within 14 days of collection. However, immediate shipping is recommended to ensure specimen integrity and suitability for analysis. Providers should not batch specimens over multiple days for shipment. See **Appendix C-Recent Memoranda** for the full memo.

A detailed tutorial is available on the NCSLPH website:
Submitting Blood Lead Specimens to the NCSLPH - Effective 01.22.2025

Steps for Collecting Fingerstick Blood Samples in Micro-Vials for Lead Testing

Place all collection materials on top of disposable pad. Open the lancet, alcohol swabs, gauze, bandage, and other items. Have all items ready for blood collection.

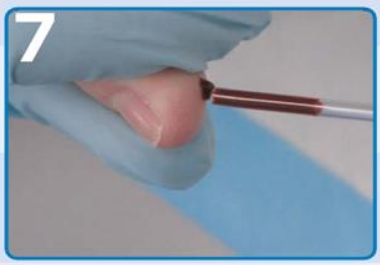
Wash the patient's hands thoroughly with soap and water. Allow them to air dry without touching any surface. Do not use paper towels to dry the patient's hands. Put on your powder free gloves.

Massage the patient's hand and lower part of the finger to increase blood flow. Turn the hand down.

Scrub the patient's middle finger or ring finger with an alcohol swab.

Hold the finger in a downward position and lance the palm side surface of the finger.

Apply slight pressure to start blood flow. Blot the first drop of blood on a gauze pad without touching the finger and discard the gauze in appropriate container.



Keep the finger in a downward position to maintain blood flow. Hold the micro-collection tube at an angle of 10 degrees below the collection site and touch the tapered end of the tube into the droplet of blood. Do not touch the skin with the tube. Fill the micro-collection vial with the appropriate amount of blood as defined by the micro-collection container that you are using.

Once you have collected enough blood, apply a slight pressure to the finger to stop the bleeding. Apply a sterile adhesive bandage over the puncture site.

Seal the specimen container and, inverting it immediately, gently invert container 7-10 times to prevent clots from forming.

Place the label on the vial. If the label contains a barcode, the barcode needs to be vertical like a ladder when placed on the vial. If the barcode is not vertical, the laboratory will not be able to read the label. Properly discard all used materials. Contact the laboratory for storage and transport guidance.

For more information visit
www.cdc.gov

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June 2021

Blood Lead Testing:
Sending Specimens to the State Lab

≥150 µL is required for testing. Seal the tube well.
Put 2 unique identifiers on the specimen tube's label.
For example, Patients First and Last Name AND Date of Birth.

Submissions with information on the tube label that does not EXACTLY match the information on the DHHS 3707 form will be REJECTED.
If the specimen label has John, the form cannot have Johnny, Johnathan, etc.

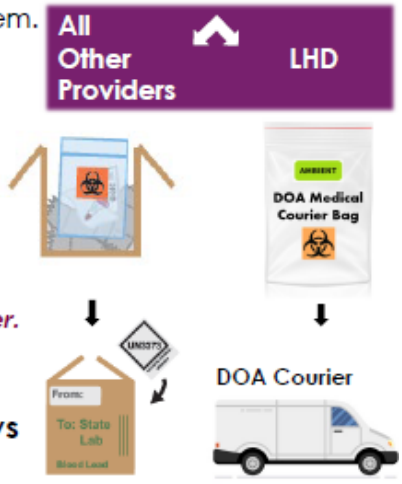
Complete the entire DHHS 3707 form for each specimen.
Available at: https:// slph.dph.ncdhhs.gov/Forms/3707-Blood-Lead-Analysis.pdf

DO NOT alter the form.
Use the most current version.
Ensure all information is accurate. Inaccurate submissions are subject to rejection.
For Medicaid patients, enter Medicaid # (required) and Member ID # (if applicable).

Place tube with absorbent material in a leak-proof specimen bag.
Slide folded DHHS 3707 form in outer sleeve of bag.
One specimen per bag.

Pack & ship specimens.
Local Health Departments please use current DOA Medical Courier system.
All Other Providers should package specimens as a UN3373 Biological Substance, Category B. Providers may order pre-paid postage Blood Lead boxes through the NCSLPH website: https://slphreporting.dph.ncdhhs.gov/labportal/. The pre-paid boxes from NCSLPH can accommodate up to 30 individual specimen bags. Please submit blood lead specimens in a timely manner to avoid specimen rejection due to delays in transport to NCSLPH.

Envelopes are not acceptable.
Attach a return address label, including responsible person & phone number.
Add cushioning to protect specimen(s) in transit.



Capillary and venous specimens must be tested within 14 days of date of collection at ambient temperature (15-38°C).
See SCOPE for alternative shipping requirements of frozen/cold specimens.

Need supplies or help? Call SLPH Customer Service at 919-733-3937, SLPH Mailroom at 919-733-7656, or visit us at https://slph.dph.ncdhhs.gov/hemachem/resources.asp

NC Department of Health and Human Services
Division of Public Health
North Carolina State Laboratory of Public Health
http://slph.dph.ncdhhs.gov 1/22/2025 NCDHHS
is an equal opportunity employer and provider.

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.dph.ncdhhs.gov/celr-user

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 (NC CLPPP) or Adult Blood Lead Epidemiology and Surveillance (ABLES) program will be immediately notified (via telephone or email) of abnormally high results (>25µg/dL) and a hard copy final report will be issued; all other results will be reported via hard copy to the provider of record.

Results are reported in micrograms per deciliter (µg/dL) of whole blood. The range of results reported is <1µg/dL to >100µg/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.dph.ncdhhs.gov/doc/SCOPE-Guide-To-Laboratory-Services.pdf

Questions? Please contact:
NCSLPH Hemachemistry Manager | 919-807-8878

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 ASAP for diagnostic (confirmatory) testing.
- Point of care capillary samples can 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 category the level was confirmed in. Consult the **Follow-up Schedule** for information on when to conduct diagnostic testing, follow-up testing, and the actions recommended for each category.
- 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 at ≥5 µg/dL. The form can be faxed, a copy mailed, or uploaded into NCLEAD, the NC lead surveillance system.
- For the purpose of environmental referrals, an "elevated blood lead level" (EBL) case is two consecutive tests ≥5 µg/dL and a "confirmed lead poisoning" (CLP) case is two consecutive tests ≥10µg/dL.

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 ≥3.5 µg/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 diagnostic 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, as outlined in the follow-up schedule. However, we recommend diagnostic/confirmatory samples be drawn as soon as possible.

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 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-Educational and Outreach Materials**).

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. 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. Past surveillance data available at https://ehs.dph.ncdhhs.gov/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.

Be sure to use Medicaid numbers on lab slips for children who are covered by Medicaid.

Including the Medicaid number ensures the child's test information can be checked against Medicaid information when there are discrepancies in demographic data. It is also important for reimbursement for specimen processing and lead investigations.

Follow-up based on confirmatory venous test results

The follow-up schedule for blood lead testing is shown on the following pages and in **Appendix J-Other Resources**. 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 them in a higher risk category, which would require a new diagnostic test to be performed.

For example, if a child was confirmed at the 5-9.99µg/dL level, but the follow-up test done a month later has a result of 11 µg/dL, that child will need a venous test for confirmation at the 10 -19.99µg/dL level.

Clinical Diagnostic and Follow-up Schedule

FOLLOW-UP SCHEDULE

Blood Lead Levels for Children Under the Age of Six

For each initial blood lead level ≥ 3.5 µg/dL, perform a diagnostic test ASAP. If diagnostic test result falls within a lower category, follow the steps within that category.

If diagnostic or follow up test result falls within a higher category, conduct another diagnostic test.

All diagnostic (i.e., confirmation) tests should be performed as soon as possible (ASAP), but at a minimum within specified time periods.

- *Diagnostic tests* should be venous; however, capillary tests are accepted if a venous cannot be obtained.
- Diagnostic specimens *must* be sent to an outside reference laboratory for analysis.
- Point of care (POC) blood lead analyzers (i.e., LeadCare) *CANNOT* be used for diagnostic/confirmatory tests.
- *Follow-up (post-diagnostic) testing* can be capillary.
- CDC protocol for collecting capillary specimens should be followed (www.cdc.gov/biomonitoring/pdf/Lead-Fingerstick-Poster-508.pdf).

See https://nchealthyhomes.com/clinical-lead-resources/ for a list of clinical resources.

Please contact Children's Environmental Health at (919) 609-0877 or Dph.LeadHelpdesk@dhhs.nc.gov for further assistance.

*Children's Developmental Services Agency (CDSA)
**Care Management for At-Risk Children (CMARC)

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

https://publichealth.nc.gov • NCDHHS is an equal opportunity employer and provider. • 11/2024

INITIAL BLOOD LEAD LEVEL AND RESPONSE

< 3.50 µg/dL

- Report blood lead test results to parents and document notification
- Educate family about lead sources and prevention of lead exposure. Printable resources are available at https://nchealthyhomes.com/lead-poisoning/.
  - Retest at age 2, earlier if risk of exposure increases.

3.50 – 4.99 µg/dL — **Perform diagnostic test ASAP**

If diagnostic test result is **3.50 – 4.99 µg/dL**, take same action as previous category **AND**

- Provide clinical management
- Conduct nutritional assessment and refer child to the WIC Program
- Test other children under the age of six in same household
- Conduct follow-up testing every 3 months until 2 consecutive tests are < 3.50 µg/dL

5.00 – 9.99 µg/dL — **Perform diagnostic test ASAP**

If diagnostic test result is **5.00 – 9.99 µg/dL**, take same action as previous category **AND**

- Complete Form 3651: Exposure History of Child with Elevated Blood Lead Level to identify possible lead sources and fax a copy to Children's Environmental Health at (919) 841-4015
- Refer case to local health department to offer an environmental investigation
- Conduct follow-up testing every 3 months until 2 consecutive tests are < 3.50 µg/dL

10.00 – 44.99 µg/dL — **Perform diagnostic test ASAP (but at the latest within 1 month at 10.00 – 19.99 µg/dL and within 1 week at 20.00 – 44.99 µg/dL)**

If diagnostic test result is **10.00 – 44.99 µg/dL**, take same action as previous category **AND**

- Refer to local health department for required environmental investigation
- Refer child to CDSA* Early Intervention or CMARC**
- Refer to Social Services as needed for housing or additional assistance
- For 10.00 – 19.99 µg/dL: Conduct follow-up testing every 1-3 months until 2 consecutive tests are < 3.50 µg/dL
- For 20.00-44.99 µg/dL: Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL and consider an abdominal X-ray to check for ingested object.

45.00 – 69.99 µg/dL — **Perform diagnostic test ASAP (but at the latest within 48 hours at 45.00 - 59.99 µg/dL and within 24 hours at 60.00 - 69.99 µg/dL)**

If diagnostic test result is **45.00 – 69.99 µg/dL**, take same action as previous category **AND**

- Consult with North Carolina Poison Control (800) 222-1222 for advice on chelation and/or hospitalization
- Perform an abdominal X-ray to check for ingested object
- Alert NC CLPPP by calling (919) 609-0877
- Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL

≥ 70.00 µg/dL — **Perform emergency diagnostic test immediately**

If diagnostic test result is **≥ 70.00 µg/dL**, take same action as previous category **AND**

- Hospitalize child and begin medical treatment immediately
- Conduct follow-up testing every 2 weeks to 1 month until 2 consecutive tests are < 3.50 µg/dL

FOLLOW-UP SCHEDULE FOR PREGNANCY

Initial Blood Lead Level (BLL) Results	Frequency of Testing	Recommended Interventions According to BLL in Pregnancy
< 5 µg/dL	• No diagnostic or follow-up testing necessary	• Educate on lead exposure sources and risk reduction
5-9 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL • **Alert baby's healthcare provider to maternal elevated blood lead level. Collect an umbilical cord blood sample or neonatal sample prior to discharge to establish a baseline level for the newborn. Neonatal samples can be venous or capillary (heel stick).**	Above actions in addition to: • Provide case management • Refer case to local health department to offer an environmental investigation • 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 and Pregnancy Brochure" (2 sided) and "Keeping Lead at Work and Preventing Take Home Exposure" • If appropriate for occupation, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • Recommend removal from workplace lead exposure
25-44 µg/dL	• Conduct diagnostic test within 1-4 weeks • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • **Advise not to breastfeed and discard breastmilk if BLL ≥ 40 µg/dL** • Testing milk is not recommended
≥ 45 µg/dL	• Conduct diagnostic test within 24 hours • Conduct follow-up testing at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs • Should be treated as a high-risk pregnancy. Patient may require transfer to a high-risk obstetrical practice.	Above actions in addition to: • Consult or transfer to a provider specializing in lead poisoning therapy before considering chelation for the patient

Testing Recommendations for Newly Arrived Refugees

Recommended Screening Measures	Population
Initial lead blood test	• All refugee infants and children ≤ 16 years of age • Refugee adolescents > 16 years of age if there is a high index of suspicion, or clinical signs/ symptoms of lead exposure • All pregnant and lactating women and girls*
Follow-up blood test, 3-6 months after initial testing	• All refugee infants and children ≤ 6 years of age, regardless of initial test result • Refugee children and adolescents 7-16 years of age who had BLLs ≥ 3.5 µg/dL, and for any child older than 7 years of age who has a risk factor (e.g., sibling with BLL ≥ 3.5 µg/dL, environmental exposure risk factors) regardless of initial test result • Pregnant or lactating adolescents (<18 years of age) who had BLLs ≥ 3.5 µg/dL at initial screening

*All newly arrived pregnant or breastfeeding women should be prescribed a prenatal or multivitamin with adequate iron and calcium. Referral to a health care provider with expertise in high-risk lead exposure treatment and management may be indicated for EBLLs.

See Page 1 for clinical follow-up and case management of children with blood lead levels ≥ 3.5 µg/dL.

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

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 µg/dL and to educate the family about lead poisoning prevention (see **Appendix D-Forms**). Form EHS 3651 is also used as a referral form to Environmental Health for a Lead Investigation. 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:

NCDHHS, Division of Public Health
Attn: Children's Environmental Health
1934 Mail Service Center, Raleigh NC 27699-1934

*NCLEAD users may scan and attach **Form EHS 3651** to the Child Event in the NCLEAD System*.

Do not send EHS 3651 before you have the diagnostic test result or if the diagnostic test result is < 5 µg/dL.

For a child with blood lead level ≥5 µg/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. Collect multiple telephone numbers for follow-up.
3. 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 NC CLPPP at (919) 841-4015.

An ***Elevated blood lead level*** case is defined as 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.

- A home lead evaluation by an environmental health specialist will be **offered** for all children under six years of age and eligible refugees with a confirmed blood lead level of **≥ 5 µg/dL.**

A ***Confirmed lead poisoning*** case is defined as 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

- A home lead evaluation is **required** for any child under six years of age and eligible refugees with a confirmed blood lead level **≥ 10 µg/dL.**

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)	• 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	• Take a diet history, including the frequency of the child's meals, snacks and beverages. Smaller and more frequent meals may be helpful since absorption of lead may be increased when the stomach is empty. • Assess the child's dietary intake of iron, calcium, vitamin C, and zinc. Deficiencies of iron, calcium and zinc may increase lead absorption or toxicity. • Ask about the source of water used for cooking, drinking and for preparing infant formula. • Ask about possible ingestion of non-food items. Anemia or iron-deficiency without anemia may predispose the child to pica (ingestion of non-food items) and increase the risk of lead ingestion. • Ask about participation in WIC and other supplemental nutritional programs and refer if the child's blood lead level is confirmed ≥ 3.5 µg/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	Laboratory: 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 ≥ 45 µg/dL) Imaging: Order an abdominal X-ray if foreign body ingestion is suspected
Referrals	Referrals are listed within our **Clinical Diagnostic and Follow-up Schedule.**
Medical History	Ask about symptoms, developmental history, mouthing activities, pica, previous blood lead level measurements, and family history of lead poisoning.

Chelation

Children with confirmed blood lead levels ≥45 µg/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 µg/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 Control Center's telephone number is (800) 222-1222.**
If additional resources are needed, contact the NC Childhood Lead Poisoning Prevention Program at (919) 707-5854 or toll-free at (888) 251-5543.

Referrals/Resources

Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Program:
Eligibility Criteria

- 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)
- Children previously referred to WIC for nutritional assistance need a re-referral for the reason of blood lead levels ≥3.5µg/dL, so that their nutritional interventions may be tailored to reduce lead absorption.

Contact your county health department or visit https://www.ncdhhs.gov/ncwic for more information.

Early Intervention (CDSA/ITP): Children with confirmed lead poisoning (≥10 µg/dL) are eligible for Early Intervention Services. Children birth to 36 months of age should be referred to the Children's Developmental Services Agency (CDSA) for Early Intervention as an entitlement of the Individuals with Disabilities Act. The CDSA contact information may be found at https://www.ncdhhs.gov/itp-beearly.

Care Management for At-Risk Children (CMARC). The Care Management of At-Risk Children (CMARC) program provides care management for non-Medicaid and Medicaid children, birth to five years of age, who have long-term medical conditions or special health care needs. For referral information and eligibility, please visit https://www.ncdhhs.gov/divisions/child-and-family-well-being/whole-child-health-section/school-adolescent-and-child-health/care-management-risk-children or contact the Children with Special Health Care Needs Help Line at 1-800-737-3028 or CYSHCN.Helpline@dhhs.nc.gov.

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/ .

Educating Families

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.

Discussion Topics:

- Child's blood lead level (if testing has taken place) and what it means, as well as the need for follow-up blood lead testing, if indicated.
- Potential adverse health effects of lead exposure.
- Sources of lead and suggestions on how to reduce exposure are outlined in **Chapter 1**. 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. Dry methods of cleaning, such as sweeping or vacuuming (unless a High Efficiency Particulate Air (HEPA) filter vacuum is used) for lead removal are ineffective. 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 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.

- Hazards of improper removal of lead-based paint. Particularly hazardous are open-flame burning, power sanding, water blasting, chemical-based stripping, and dry sanding or scraping.

- 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 ensure there is adequate intake of iron, vitamin C, calcium and zinc. Encourage regular meals and snacks.

Printed materials, videos, and resource links are encouraged to be shared with families so they can refer to them as needed. 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).

Please refer to **Appendix E- Educational and Outreach Materials** for printable resources. These materials (and more!) can be found at https://nchealthyhomes.com/lead-poisoning/.

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.
- No amount of lead is considered safe, but a confirmed blood lead level (BLL) ≥5 µg/dL is the action level recommended by the Centers for Disease Control and Prevention (CDC) for pregnant people. A pregnant person with a confirmed BLL ≥10 µg/dL should be removed from work-related exposure.
- Babies born to pregnant people with a confirmed BLL ≥5 µg/dL during pregnancy should also be tested. Umbilical cord blood or a neonatal sample should be taken at delivery or prior to discharge from the birthing facility.

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. The American College of Obstetricians and Gynecologists (ACOG) published a committee opinion paper in 2012 (reaffirmed in 2023) 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."

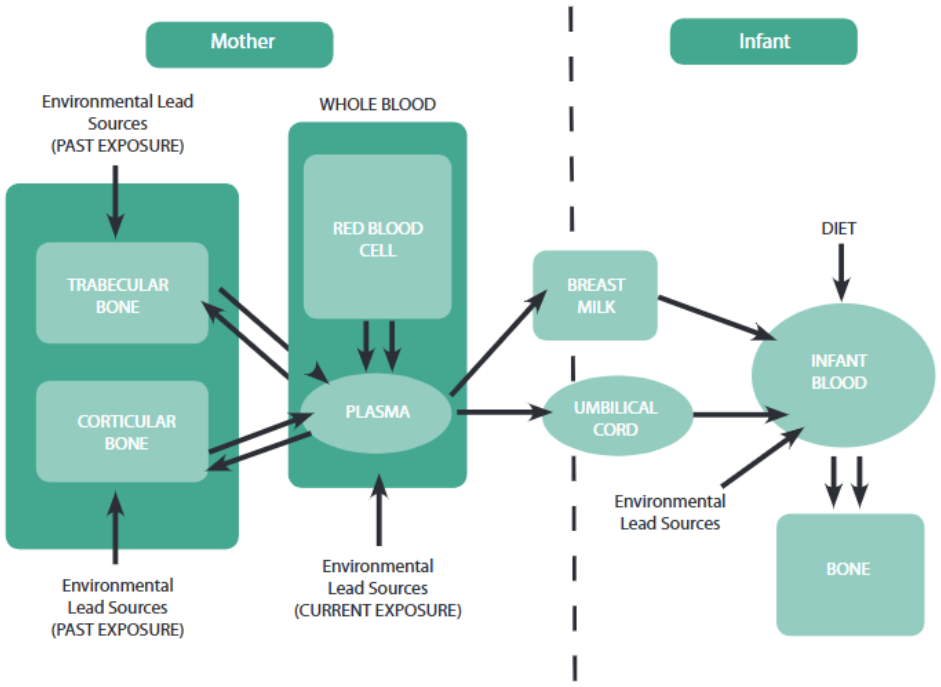
The purpose of this chapter is to discuss how prenatal exposure to lead can occur, when to order a blood lead test for a pregnant or lactating woman, the harmful effects of lead exposure on the health of mother and baby, the recommended management of exposed patients, and resources available through the Division of Public Health.

The information is this chapter aligns with guidelines published by the American College of Obstetricians and Gynecologists (ACOG) and Center for Disease Control and Prevention (CDC).
Lead Screening During Pregnancy and Lactation | ACOG
and
CDC Guidelines for the Management of Lead Exposure in Pregnant and Lactating Women

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. Lead can also be inhaled and absorbed by lung tissue. While blood lead is the preferred biomarker for lead exposure, most lead in the body is stored in bone, and pregnancy and lactation are periods when increased bone turnover may cause 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 breast milk for lead is not commonly performed unless for research. Postpartum, breastfeeding is encouraged unless the BLL ≥40µg/dL. If a mother has a BLL ≥40µg/dL, pumping and discarding of breastmilk is recommended until the BLL decreases.

Figure 3-1. Major Lead Exposure Pathways from Mother to Infant



Source: CDC- Guidelines for the identification and management of lead exposure in pregnant and lactating women (cdc.gov), page 33

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. Studies have shown a relationship between high blood lead levels and spontaneous pregnancy loss (also known as spontaneous abortion or miscarriage) as well as lower birth weights. 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. Please refer to ACOG and the CDC documents shared previously for links to supporting studies.

Risk Factors for Exposure

The environmental risk factors previously discussed for children in **Chapter 1** also apply to pregnant people. Additional risk factors include occupational and hobby exposure and nutritional status during pregnancy.

OCCUPATIONAL

There are industries in North Carolina that use or produce lead, and the worker can carry lead dust into their home or car unknowingly. Asking about possible occupational exposure for all members of the household is an important part of the risk assessment. Manufacturing of lead oxide and battery reclamation or manufacture are high-risk industries. 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

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.

PICA

Women engaging in pica, the consumption of non-food items, may ingest lead through contaminated soil, paint, or metallic items. Pica is more common in children but can also be seen in pregnancy and may be linked to iron deficiency.

NUTRITIONAL STATUS

Iron deficiency, anemia (lower than normal hemoglobin), and 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. For pregnant people with a BLL ≥5µg/dL, the CDC recommends a total daily calcium intake of 2,000 mg through diet and supplementation. Pregnant people should also be screened for iron deficiency and treated as per usual recommendations for pregnancy.

Screening for lead exposure during pregnancy and lactation

The CDC and ACOG recommend the use of a risk assessment tool.
See North Carolina's **Form 4116-Lead and Pregnancy Risk Questionnaire**
to identify women who should be screened for lead exposure.
If any risk factor is identified, a blood lead test should be ordered.

Our risk questionnaire is also available at https://nchealthyhomes.com/lead-poisoning/ and https://wicws.dph.ncdhhs.gov/provPart/forms.htm.

Ordering Prenatal Blood Lead Tests in North Carolina

Any prenatal care provider can order a prenatal blood lead test and lead testing will be provided at no charge by the State Laboratory of Public Health for pregnant women. More information on State Lab procedures is found in **Chapter 3.**

All tests should be venous samples and analysis should be done at a reference laboratory.
Do not use a point of care lead analyzer to screen patients prior to sending a venous test.
Venous samples cannot be processed on a point of care lead analyzer.

A 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 ≥5µg/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 in **Appendix H- Lead and Pregnancy Resources** and in the links below.

Management of blood lead test results

The recommended public health action level for pregnant people is a *confirmed* BLL ≥5 µg/dL. If an initial BLL is elevated, a second venous sample should be drawn and sent to a reference laboratory for confirmation. *Any pregnant person with a confirmed BLL at or above the action level of 5µg/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 found within this chapter or in **Appendix H- Lead and Pregnancy Resources**.

Lead and Pregnancy Brochure:

English | Spanish | Dari | Pashto

FOLLOW-UP SCHEDULE FOR PREGNANCY

Initial Blood Lead Level (BLL) Results	Frequency of Follow-Up Testing	Recommended Interventions According to BLL in Pregnancy
< 5 µg/dL	• No diagnostic or follow-up testing necessary	• Educate on lead exposure sources and risk reduction
5-9 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL • **Alert baby's health care provider to maternal elevated blood lead level. Collect an umbilical cord blood sample or neonatal sample prior to discharge to establish a baseline level for the newborn. Neonatal samples can be venous or capillary (heel stick).**	Above actions in addition to: • Provide case management • Refer case to local health department to offer an environmental investigation • 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 and Pregnancy Brochure" (2 sided) and "Keeping Lead at Work and Preventing Take Home Exposure" • If appropriate for occupation, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • Recommend removal from workplace lead exposure
25-44 µg/dL	• Conduct diagnostic test within 1-4 weeks • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • **Advise not to breastfeed and discard breastmilk if BLL ≥ 40 µg/dL** • Testing milk is not recommended
≥ 45 µg/dL	• Conduct diagnostic test within 24 hours • Conduct follow-up testing at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs • Should be considered and treated as high-risk pregnancy. Patient may require transfer to a high-risk obstetrical practice.	Above actions in addition to: • Consult or transfer to a provider specializing in lead poisoning therapy before considering chelation for the patient

FOLLOW-UP SCHEDULE FOR BREASTFEEDING

Initial Blood Lead Level (BLL) Results	Frequency of Follow-Up Testing
5-19 µg/dL	• Every 3 months, unless infant blood lead levels are rising or fail to decline.
20-39 µg/dL	• Maternal BLL 2 weeks postpartum and then at 1 to 3-month intervals depending on trend in infant BLLs
≥ 40µg/dL	• 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.**

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 ≥45µg/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 ≥70µg/dL may cause significant toxicity, including cerebral edema (brain swelling), and should be treated as a medical emergency.

Medical providers can contact **NC Poison Control at (800) 222-1222** (available 24/7) if urgent medical toxicology consultation is needed.

Testing in Newborns and Infants <6 Months of Age

Umbilical cord blood or neonatal BLL (via venous sample or capillary heel stick) should be measured at birth for all babies born to mothers with a confirmed BLL ≥5 µg/dL during pregnancy. Follow-up testing is guided by the schedule below. After one month, consult our **Follow-Up Schedule** for children under the age of six.

Table 5-1. Follow-up of Initial Blood Lead Testing of the Neonate (<1 Month of Age)

Initial Venous Blood Lead Level[a] (BLL; µg/dL)	Perform follow-up test(s)[b]
<5	According to local lead screening guidelines for children.
5-24	Within 1 month (at first newborn visit).[c]
25-44	Within 2 weeks. Consultation with a clinician experienced in the management of children with BLLs in this range is strongly advised.[d]
≥45	Within 24 hours and then at frequent intervals depending on clinical interventions and trend in BLLs. Prompt consultation with a clinician experienced in the management of children with BLLs in this range is strongly advised.[d]

[a]The initial blood lead level may be either from an umbilical cord sample at the time of delivery or an infant venous BLL. A venous blood sample is preferred over a capillary sample. Decisions to initiate or stop breastfeeding or initiate chelation therapy should be based on venous blood lead test results only.

Source: CDC- Guidelines for the identification and management of lead exposure in pregnant and lactating women (cdc.gov), page 84

FORMS

Form 4116- Lead and Pregnancy Risk Questionnaire
https://wicws.dph.ncdhhs.gov/Forms/4116E-LeadandPregnancyRisk.pdf (English)
https://wicws.dph.ncdhhs.gov/Forms/4116S-LeadandPregnancyRiskSpanish.pdf?ver=1.1 (Spanish)

Prenatal Lead Investigation Referral Form
https://ehs.dph.ncdhhs.gov/docs/forms/cehu/DHHS3460PInvestigationsHazards-FINAL.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.

Blood Lead Reference Value (BLRV). 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 3.5 µg/dL.

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 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 3.5 µg/dL or greater. Venous samples are preferred and diagnostic tests must be sent to an outside reference laboratory.

Elevated Blood Lead Level (EBL). A blood lead concentration of ≥5-9.99 µg/dL determined by the value of the lower of two consecutive blood tests within a 12-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/).

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:

- Their child's blood lead level, and what it means.
- Potential adverse health effects of lead exposure.
- Sources of lead and suggestions on how to reduce exposure.
- 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.
- 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.
- The need for follow-up blood lead testing to monitor the child's blood lead level, as appropriate.
- Results of environmental investigation, as appropriate.
- Hazards of improper removal of lead-based paint. Particularly hazardous are open-flame burning,

power sanding, water blasting, chemical-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 they have a level at or above the BLRV.

Immigrant. An individual admitted to the United States (or any other country) as a lawful permanent resident.

Migrant. A person who moves away from their place of usual residence, whether within a country or across an international border, temporarily or permanently.

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. 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.

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

REGIONAL ENVIRONMENTAL HEALTH SPECIALISTS (CLPPP)

Territory Map: https://nchealthyhomes.com/wp-content/uploads/sites/6517/2025/01/CEH-RegionalMap_FINAL-Effective-2.2025.pdf

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ASHLEY MIZE
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COUNTIES: Caswell, Davie, Forsyth, Granville, Person, Rockingham, Stokes, Surry, Vance

BARRETTE GREGORY
Regional Environmental Health Specialist
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CARISSA MOORE
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Regional Environmental Health Specialist
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MEGAN LEE
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PHONE: (252) 665-1828 | EMAIL: Megan.Lee@dhhs.nc.gov
COUNTIES: Beaufort, Craven, Greene, Hyde, Jones, Lenoir, Nash, Pamlico, Pitt, Wayne, Wilson

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NC CHILDHOOD LEAD POISONING PREVENTION PROGRAM (CLPPP)

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

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Data Management, Surveillance, Data Requests

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Children's Environmental Health Operations

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Surveillance, Medicaid Billing, REHS (see below)

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Clinical Outreach and Follow-up, Surveillance

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Data Management, Surveillance

STATE LABORATORY OF PUBLIC HEALTH

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Blood Lead Analysis

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Environmental Sample Analysis

OTHER LEAD CONTACTS

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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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CDC Childhood Lead Poisoning Prevention Grant; Lead and Healthy Homes Training, Educational Materials

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Refugee Health Program

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Adult Blood Lead Epidemiology and Surveillance (ABLES), Occupational Exposures

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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. This is no longer done. Page 3 of the document states a reference value of 5 µg/dL, which was lowered to 3.5 µg/dL by the CDC in 2021. Additionally, because the bulletin was published in 2015, links throughout may no longer be active. The 2015 bulletin is the most recent available regarding POC analyzers.

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 the NC CLPPP. To make arrangements for reporting of blood lead test results, please email Dph.LeadHelpdesk@dhhs.nc.gov. 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

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 (µg/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 <5.0µg/dL should be *truncated* to 4 µg/dL. Note: The need for confirmation testing is based on the rounded test result. For example, test results between 4.5 to 4.9 µg/dL should be rounded up to 5 µg/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. Heath 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

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

Pat McCrory
Governor

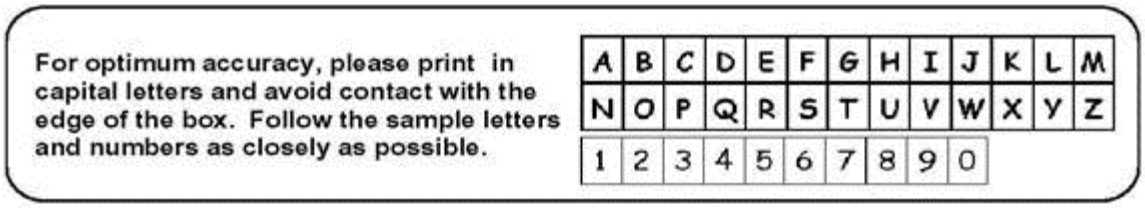
Aldona Z. Wos, M.D.
Ambassador (Ret.)
Secretary DHHS

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

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.



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.

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES

ROY COOPER • Governor
KODY H. KINSLEY • Secretary
HELEN WOLSTENHOLME • Interim Deputy Secretary for Health
MARK T. BENTON • Assistant Secretary for Public Health
Division of Public Health

March 21, 2022

M E M O R A N D U M

FROM: Ed Norman, Program Manager
NC Childhood Lead Poisoning Prevention Program
Environmental Health Section
TO: Local Health Directors & Private Medical Providers
RE: Revised Follow-Up Schedule for Blood Lead Testing

Last fall, the Centers for Disease Control and Prevention (CDC) lowered the blood lead reference value (BLRV) for children from 5 micrograms per deciliter (µg/dL) to 3.5 µg/dL in response to the Lead Exposure Prevention and Advisory Committee (LEPAC) recommendation made in May 2021. Children with blood lead levels at or above the BLRV represent those with the highest levels of lead in their blood compared to other children in the U.S. As a result of these recently revised recommendations from the CDC, the NC Childhood Lead Poisoning Prevention Program has revised its follow-up schedule for blood lead levels of children under the age of six.

The most significant revision is the recommendation to perform a diagnostic test for all children who have an initial blood lead test result greater than or equal to 3.5 micrograms per deciliter (µg/dL), and if confirmed, provide recommended clinical follow-up services. North Carolina anticipates that this change will increase the need for diagnostic testing by four-fold under the revised protocol compared to the previous guidelines which recommended diagnostic testing beginning at 5 µg/dL.

Mandated environmental follow-up services are not affected by these revised recommendations; however, clinical case management is recommended for children confirmed to have a blood lead level ≥ 3.5 µg/dL. The revised follow-up schedule summarizing these recommendations is attached.

We appreciate your cooperation in implementing these revised recommendations. For more information, please contact Ed Norman at (919) 707-5951 or at ed.norman@dhhs.nc.gov.

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES • DIVISION OF PUBLIC HEALTH
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AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

JOSH STEIN • Governor
DEVDUTTA SANGVAI • Secretary
KAREN BURKES • Acting Deputy Secretary for Health
KELLY KIMPLE • Acting Director, Division of Public Health
SCOTT M. SHONE• Laboratory Director, State Laboratory of Public Health

Memo

To: Submitters of Clinical Specimens to the North Carolina State Laboratory of Public Health

From: Scott M. Shone, PhD, HCLD (ABB) – Director, State Laboratory of Public Health

Date: January 15, 2025

Re: Revised Specimen Requirements for Blood Lead Testing

The North Carolina State Laboratory of Public Health (NCSLPH) is implementing changes to the clinical specimen submission, packaging, and shipping procedures and policies for blood lead testing.

Effective January 22, 2025, the NCSLPH is revising the acceptance criteria for capillary and venous blood lead specimens to (14) days from the date of collection to testing for capillary and venous specimens stored and transported to the laboratory at ambient (15 to 38°C) temperatures. Ambient temperature is the preferred storage and transport temperature for blood lead specimens. For storage and transport of blood lead specimens at cold (2 to 8°C) or frozen (-15 to -25°C) temperatures, please see Appendix A in SCOPE: A Guide to Laboratory Services for guidance. Specimens received outside of the required acceptance criteria after January 22, 2025 will be rejected for blood lead testing.

Providers should not batch specimens over multiple days for shipment. All specimens submitted to NCSLPH must be labeled with two patient identifiers that exactly match information submitted on a completed DHHS form 3707 BloodLead_NPI_V11_Insur (5028 - Activated, VersiForm) (ncdhhs.gov).

Pre-paid shipping boxes are available for all providers submitting blood lead specimens who do not use the NC DOA Medical Courier. These pre-paid shipping boxes may be ordered from the NCSLPH website: https://slphreporting.dph.ncdhhs.gov/labportal. Local Health Departments should continue to use the current blood lead specimen bags for transport of blood lead specimens through the NC DOA Medical Courier in accordance with current policies and procedures.

These changes to the Blood Lead clinical specimen acceptance criteria reflect a quality improvement initiative to help assure accurate and reliable test results. If you have any questions, please contact the NCSLPH Customer Service team at 919-733-3937 or check the NCSLPH website N.C. DPH: State Lab > Hemachemistry (ncdhhs.gov) for additional guidance.

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES • DIVISION OF PUBLIC HEALTH • STATE LABORATORY OF PUBLIC HEALTH
LOCATION: 4312 District Drive, Raleigh, NC 27607
MAILING ADDRESS: 1918 Mail Service Center, Raleigh, NC 27699-1918
www.ncdhhs.gov • http://publichealth.nc.gov • https://slph.dph.ncdhhs.gov/ • TEL: 919-733-7834 • FAX: 919-733-8695
AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

≥150 µL is required for testing. Seal the tube well.
Put 2 unique identifiers on the specimen tube's label.
For example, Patients First and Last Name AND Date of Birth.
Submissions with information on the tube label that does not <u>EXACTLY</u> match the information on the DHHS 3707 form will be <u>REJECTED</u>. If the specimen label has John, the form cannot have Johnny, Johnathan, etc.

Complete the entire DHHS 3707 form for each specimen.
Available at: https:// slph.dph.ncdhhs.gov/Forms/3707-Blood-Lead-Analysis.pdf
DO NOT alter the form.
Use the most current version.
Ensure all information is accurate. Inaccurate submissions are subject to rejection. For Medicaid patients, enter Medicaid # (required) and Member ID # (if applicable).

Place tube with absorbent material in a leak-proof specimen bag. Slide folded DHHS 3707 form in outer sleeve of bag.
One specimen per bag.

Pack & ship specimens.
Local Health Departments please use current DOA Medical Courier system.
All Other Providers should package specimens as a UN3373 Biological Substance, Category B**.** Providers may order pre-paid postage Blood Lead boxes through the NCSLPH website: https://slphreporting.dph.ncdhhs.gov/labportal/. The pre-paid boxes from NCSLPH can accommodate up to 30 individual specimen bags. Please submit blood lead specimens in a timely manner to avoid specimen rejection due to delays in transport to NCSLPH.

Envelopes are not acceptable.

Attach a return address label, including responsible person & phone number. Add cushioning to protect specimen(s) in transit.

Capillary and venous specimens must be tested within 14 days of date of collection at ambient temperature (15-38°C).
See SCOPE for alternative shipping requirements of frozen/cold specimens.

Need supplies or help? Call SLPH Customer Service at 919-733-3937, SLPH Mailroom at 919-733-7656, or visit us at https://slph.dph.ncdhhs.gov/hemachem/resources.asp

NC Department of Health and Human Services
Division of Public Health
North Carolina State Laboratory of Public Health
http://slph.dph.ncdhhs.gov 1/22/2025 NCDHHS is an equal opportunity employer and provider.

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

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

NC Department of Health and Human Services
Division of Public Health

EXPOSURE HISTORY OF CHILD WITH ELEVATED BLOOD LEAD LEVEL

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
☐	☐	Does child play in dirt?	_____
☐	☐	Does child put fingers in mouth?	_____
☐	☐	Have you ever seen child eat a paint chip, plaster or chew on painted surfaces?	_____
☐	☐	Does child eat or chew on other non-food items?	_____
☐	☐	Does family recycle or store old car batteries?	_____
☐	☐	Does family use the following for fuel: painted boards?	_____
☐	☐	battery casings?	_____
☐	☐	Are there plastic or vinyl miniblinds at the child's home?	

EHS 3651 (Revised 03/16)
Environmental Health Section (Review 04/16)

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

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

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

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

EHS 3651 (Revised 03/16)
Environmental Health Section (Review 04/16)

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	

☐ Acceptance Criteria Not Met
Reason:_____
Date: _____ Initials:_____

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

First **MI**

[2] Address

Address

City

Attach Approved Printed Label Below

[3] County **State** **Zip Code**

[4] Local Pt. ID **SSN** - -

[5] Date of Birth (MM/DD/CCYY) / /

[6] Medicaid Client If yes, enter # ☐ Yes ☐ No

[7] Dx Code/ ICD

[8] Race (mark all that apply)
- ☐ White
- ☐ Black
- ☐ Asian
- ☐ American Indian/Alaska Native
- ☐ Native Hawaiian/Pacific Isles
- ☐ Unknown

[9] Ethnicity
- ☐ Hispanic
- ☐ Non-Hispanic
- ☐ Unknown

[10] Sex
- ☐ Male
- ☐ Female

[11] Other (mark all that apply)
- ☐ Refugee (up to 16 years of age, see definition below)
- ☐ Child (up to 6 years of age)
- ☐ Prenatal
- ☐ WIC Patient

Specimen

[12] ESSENTIAL SPECIMEN DATA

Date Collected (MM/DD/CCYY) / /

- ☐ Microtainer
- ☐ Venous
- ☐ Initial blood lead test
- ☐ Follow-up blood lead test

[13] EIN / Federal Tax Number -

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 _____

LAB

[14] Enter last name and NPI or ordering provider

NPI Number

Ordering Provider Last Name

Lab Use Only

Bar Code

- ☐ Specimen Missing
- ☐ Submitter info not provided

Unsat Code_____

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.

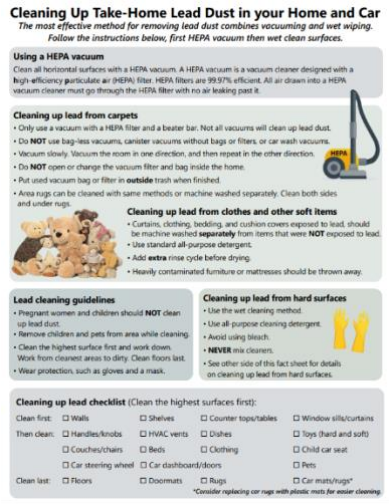
Appendix E: Educational Materials

NORTH CAROLINA RESOURCES

ARE YOU PREGNANT? PROTECT YOUR BABY FROM LEAD POISONING

This brochure provides information on protecting pregnant women and their infant children from lead exposure. The brochure is available in English and Spanish.
Prevent Lead in Pregnancy July-2017 English (nchealthyhomes.com)
Prevent Lead in Pregnancy July-2017 Spanish (nchealthyhomes.com)
Prevent Lead in Pregnancy July-2017 Dari (nchealthyhomes.com)
Prevent Lead in Pregnancy July-2017 Pashto (nchealthyhomes.com)

CLEANING UP TAKE-HOME LEAD DUST IN YOUR HOME AND CAR



This fact sheet provides information and images that show effective ways for cleaning up lead-based paint dust. The fact sheet is available in English, Spanish, Dari, and Pashto.
Cleaning Up Lead English (nchealthyhomes.com)
Cleaning Up Lead Spanish (nchealthyhomes.com)
Cleaning Up Lead Dari (nchealthyhomes.com)
Cleaning Up Lead Pashto (nchealthyhomes.com)

KEEPING LEAD AT WORK AND PREVENTING TAKE-HOME LEAD EXPOSURE

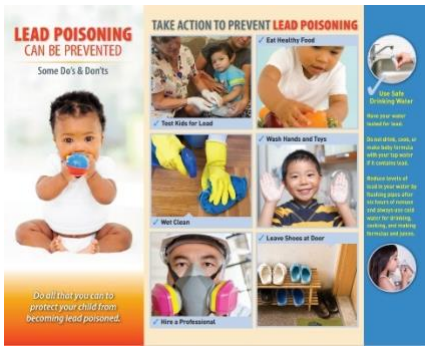
Lead dust can be carried home on a person's clothes, shoes, skin and hair after work or hobbies, and families, vehicles, and home interiors could be exposed. This low literacy fact sheet provides information and images that show effective ways for preventing that exposure while at work and when coming home after work. It is available in English, Spanish, Dari, and Pashto.
Keeping Lead at Work English (nchealthyhomes.com)
Keeping Lead at Work Spanish (nchealthyhomes.com)
Keeping Lead at Work Dari (nchealthyhomes.com)
Keeping Lead at Work Pashto (nchealthyhomes.com)

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, Spanish, Burmese, Dari, Hindi, Mandarin, and Pashto.

Factsheet-Lead-in-Spices_English (nchealthyhomes.com)
Factsheet-Lead-in-Spices_Spanish (nchealthyhomes.com)
Factsheet Lead in Spices_Burmese (nchealthyhomes.com)
Factsheet-Lead-in-Spices_Dari (nchealthyhomes.com)
Factsheet-Lead-in-Spices_Hindi (nchealthyhomes.com)
Factsheet-Lead-in-Spices_Mandarin (nchealthyhomes.com)
Factsheet-Lead-in-Spices_Pashto (nchealthyhomes.com)

LEAD POISONING CAN BE PREVENTED: SOME DO'S AND DON'TS



This brochure provides information on sources of lead exposure and ways that families can protect their children from it. The brochure is available in English, Spanish, Dari, and Pashto.
Prevent-Lead-in-Children_English (nchealthyhomes.com)
Prevent-Lead-in-Children_Spanish (nchealthyhomes.com)
Prevent-Lead-in-Children_Dari (nchealthyhomes.com)
Prevent-Lead-in-Children_Pashto (nchealthyhomes.com)

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/

2023 CLINICAL LEAD TRAINING: POLICIES, CASE MANAGEMENT, AND OTHER BEST PRACTICES

This comprehensive training provides information on the primary sources of lead exposure and poisoning, testing recommendations and prevention methods. 2023 Clinical Lead Training Archive - NC Healthy Homes

NORTH CAROLINA HEALTHY HOMES

NC CHILD/LEAD FREE NC

Lead Free NC is a project of NC Child and our partners around the state. We envision a North Carolina where every child – whatever their race, ethnicity or place of birth – can grow up healthy and meet developmental milestones free from toxic lead. https://leadfreenc.org/ and https://ncchild.org/what-we-do/lead-free-nc/

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

US DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

The US Department of Housing and Urban Development published a booklet 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/dfiles/HH/documents/HYHH_Booklet.pdf

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

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/lead-prevention/about/?CDC_AAref_Val=https://www.cdc.gov/nceh/lead/default.htm

NATIONAL CENTER FOR 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/

ENVIRONMENTAL PROTECTION AGENCY (EPA)

This pamphlet, developed by the Environmental Protection Agency (US EPA), 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

Federal law requires contractors that disturb painted surfaces in homes, childcare facilities and schools built before 1978 to be certified and follow specific work practices to prevent lead contamination. This guide from the EPA shares valuable information for residents and childcare center operators who may hire contractors.
N.C. DHHS: The Lead-Safe Certified Guide to Renovate Right (nchealthyhomes.com)
Remodelar Correctamente (nchealthyhomes.com)

LEAD SAFE MAMA

Tamara Rubin is a documentary filmmaker and award-winning advocate for childhood lead poisoning prevention and consumer good safety. She runs Lead Safe Mama LLC, which is a collaborative community dedicated to lead testing of food and consumer goods. By increasing awareness of lead risks in our environment, Lead Safe Mama seeks to hold manufacturers accountable and spread the message that all children are at risk of lead exposure, not just certain segments of the population. https://tamararubin.com/about/

UNLEADED KIDS

Unleaded Kids is a nonprofit working to address major gaps in lead policy in the United States. Tom Neltner, a leader in protecting children from lead poisoning over the past 25 years, founded the group and serves as the national director. Unleaded Kids builds on Neltner's track record of success collaborating with businesses, elected officials, advocacy groups, health professionals, government agencies, community-based organizations, and individuals to better protect children from harmful chemicals. https://unleadedkids.org/

INTERNATIONAL RESOURCES

PARTNERSHIP FOR A LEAD-FREE FUTURE

UNICEF Executive Director Catherine Russell and USAID Administrator Samantha Power launched the Partnership for a Lead-Free Future during the UN General Assembly high-level week in September 2024. As the first-ever global, public-private partnership dedicated to tackling lead exposure in low- and middle-income countries, it is bringing together governments, civil society and the private sector to help end childhood lead poisoning by 2040.
https://www.leadfreefuture.org/resources/resource-library

WORLD HEALTH ORGANIZATION (WHO)

UNICEF Executive Director Catherine Russell and USAID Administrator Samantha Power launched the Partnership for a Lead-Free Future during the UN General Assembly high-level week in September 2024. As the first-ever global, public-private partnership dedicated to tackling lead exposure in low- and middle-income countries, it is bringing together governments, civil society and the private sector to help end childhood lead poisoning by 2040.
https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health

MATERIALS FOR YOUNG CHILDREN

HAPPY, HEALTHY, LEAD-FREE ME!

The New Hampshire Department of Health and Human Services, in collaboration with the New Hampshire Chapter of the American Academy of Pediatrics, developed this engaging rhyming children's book that educates on lead poisoning prevention and the importance pediatric lead testing. Free digital copies are available in several languages using the link below. Physical copies are also available to order.
https://cribsforkids.org/happy-healthy-lead-free-me/

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 about healthy homes principles and simple ways that children and adults can apply those principles in their homes. In additional to a print version of this book, the website contains an activity book, a teacher guide and an animated video of the book. https://healthyhomes.uconn.edu/healthy-environments-for-children/

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://stacks.cdc.gov/view/cdc/19571

Appendix F: Nutrition

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 current CDC recommendations for follow-up testing based on a blood lead reference value of 3.5 ug/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 FOCUS

for children with special health care needs

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Childhood Lead Poisoning and the Role of Nutrition

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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.

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 (□g/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 ≥10 µg/dL.[1] Moreover, among U.S. children ages 1-5 who had BLLs ≥20 µg/dL, 83% were Medicaid enrollees, as were 60% of those with BLLs ≥10 µg/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 ≥10 µg/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, documented 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 (≥70 µg/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 µg/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 re- searchers.

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 supple- ments 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 (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 ≥45µg/dL.[7] An oral chelating agent, "succimer", that can be used on an outpatient basis, was approved for use in

Table 2
Interpretation of Screening Test Results and Recommended Follow-up

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 ChildhoodLead Poisoning Prevention. March 200

children with blood leads ≥ 45 µg/dL. Chelation therapy may be considered if the BLLs are ≥25 µg/dL however recent studies concluded that this treatment offers limited benefits to children with BLLs < 45 µg/dL. A randomized, placebo-controlled, double blind trial of chelation therapy in 780 children with BLLs less than 45 µg/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 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 µg/dL compared to adults.

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 µg/ dL)?
- Live in or regularly visit a house that contains vinyl mini-blinds?

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 gasoline; 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 µg/dL or above not breastfeed their in-

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 be- tween 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 ≥ 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, bever- ages 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

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.

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

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 activities 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 in- takes among low-income preschoolers.[13] WIC had significantly posi- tive 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, pro- viding 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 be- low which no health effects occur. It is imperative that pre-school children be tested for lead poisoning, especially at ages 1 and 2 years. Health care 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
Anthropometric • Assess growth parameters including: - 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	• *Child's weight-for-age is tracking above or below the highest or lowest growth channels or deviating from the child's "normal."* • *Child's length/height-for-age is deviating from the child's "normal."* • *Child is failing to track their "normal" growth channel for weight-for-length or BMI-for-age percentile.* • *Child (one year or older) is gaining excessively (> 1lb in 6 months) or inadequately (< 1 lb in 6 months).*	
Biochemical • Assess test results for blood lead level • Asses hemoglobin or hematocrit for iron	• *Child's BLL ≥ 5 ug/dL.* • *Child's hgb/hct < 11.0 or 33%.*	
Clinical • Determine nutritional implications of medical management of lead toxicity	→	*Coordinate care with child's health care provider.*
Dietary • Screen dietary intake for: - 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	• *Child is eating < 3 meals and 2 snacks daily.* • *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.* • *Tap water is not flushed before using or warm water from tap is used for food preparation or drinking.* • *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.* • *Child is eating imported, canned foods or spices.* • *Child is given traditional remedies with high lead content.*	
Ecosocial • Review findings from environmental assessment if available • Question regarding pica or excessive mouthing behaviors • Assess home sanitation: - meal preparation area - hand-washing practices - washing pacifiers/bottle nipples/toys	• *Child is eating non-food items.* • *Child has normal (developmental stage) mouthing behaviors that may increase exposure to lead.* • *Child's food is prepared in an area that may be exposed to lead dust.* • *Child's hands are not routinely washed before eating.* • *Child's toys, pacifiers and bottle nipples are not washed regularly.*	
NC CLPPP – March 2016		Referrals: O WIC O Other: _____

Appendix G: 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 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.

In addition to Appendix G, the following links are helpful references for refugee populations:

CDC: Lead Screening Guidelines for Refugee Children
https://www.cdc.gov/immigrant-refugee-health/hcp/domestic-guidance/lead.html

CDC: Risk Factors and Refugees and Immigrants
https://www.cdc.gov/lead-prevention/risk-factors/refugees-immigrants.html

CDC: Nutrition
https://www.cdc.gov/immigrant-refugee-health/hcp/domestic-guidance/nutrition-and-growth.html

LEAD SCREENING DURING THE DOMESTIC MEDICAL EXAMINATION FOR NEWLY ARRIVED REFUGEES

Centers for Disease Control and Prevention: Immigrant and Refugee Health
February 23, 2022

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

Key Points

- Lead exposures among newly arrived refugees may include environmental and occupational exposures, as well as household and personal items.
- Table 1 describes the lead screening recommendations for newly arrived refugee infants, children, adolescents, and pregnant and lactating women and girls.
- In October 2021, CDC lowered the blood lead reference value (BLRV) to 3.5 micrograms per deciliter (µg/dL) to identify children with higher levels of lead in their blood compared to most children. Capillary screening results at or above 3.5 µg/dL should be confirmed with blood drawn by venipuncture. The previous BLRV was 5 µg/dL.
- This level is based on the on the 97.5th percentile of the blood lead distribution of US children aged 1–5 years from the National Health and Nutrition Examination Survey (NHANES). Children with blood lead levels at or above the BLRV are among the 2.5% of US children with the highest blood lead levels.
- See the CDC Childhood Lead Poisoning Prevention Program *Recommended Actions Based on Blood Lead Level* for information on confirmatory testing, clinical follow-up, and case management of children with BLLs at or above the BLRV of 3.5 µg/dL.

Table 1. Screening recommendations for all newly arrived refugee infants, children, adolescents, and pregnant and lactating women and girls

Recommended Screening Measures	Population
Initial lead exposure screening with blood test	• All refugee infants and children ≤ 16 years of age • Refugee adolescents > 16 years of age if there is a high index of suspicion, or clinical signs/symptoms of lead exposure • All pregnant and lactating women and girls*
Follow-up testing with blood test, 3-6 months after initial testing	• All refugee infants and children ≤ 6 years of age, regardless of initial screening result • Refugee children and adolescents 7–16 years of age who had BLLs at or above 3.5 µg/dL, and for any child older than 7 years of age who has a risk factor (e.g., sibling with BLL at or above 3.5 µg/dL, environmental exposure risk factors) regardless of initial test result. • Pregnant or lactating adolescents (<18 years of age) who had BLLs at or above 3.5 • µg/dL at initial screening.
*All newly arrived pregnant or breastfeeding women should be prescribed a prenatal or multivitamin with adequate iron and calcium. Referral to a health care provider with expertise in high-risk lead exposure treatment and management may be indicated for EBLLs.	

BACKGROUND

Lead is a known neurotoxicant, and exposure can result in EBLL [4]. Around the world, including many countries where refugees originate or seek asylum, environmental lead hazards are common and may include leaded gasoline, industrial emissions, lead-based paint, and burning of waste containing lead. Other environmental and occupational exposures include living near or working in mines, ammunition manufacturing, smelters, or battery recycling facilities. Furthermore, household and personal use items have been associated with increased lead levels, both before and after US arrival, such as car batteries used for household electricity, lead-glazed pottery, pewter or brass utensils or cooking pots, pressure cookers, leaded crystal, and chipped or cracked dishes [5-8]. Additionally, refugees may use or consume products contaminated with lead such as traditional remedies, herbal supplements, spices, candies, cosmetics, and jewelries or amulets. Table 2 lists examples of traditional remedies, cosmetics, and foods that have been associated with EBLL in children.

Table 2. Examples of culture-specific exposures associated with elevated blood-lead levels in children.

Exposure	Origin	Reported Uses and Treatment	Description
Azarcon or greta (alarcon, azoque, coral, liga, maria, luisa, or rueda) or albayalde[6-8]	Central America and Mexico	Treatment believed to alleviate digestive problems such as upset stomach, infantile colic, constipation, diarrhea, or vomiting. Also used to soothe teething babies.	Yellow or orange powder added to oil, milk, sugar, tea, or tortilla dough. It may also be present in lead-glazed ceramic ware or baby bottles
Ba-baw-san, Bo Ying [9]	China	Believed to treat colic or respiratory symptoms	Herbal medicine or gray powder
Bint Al Zahab (Daughter of Gold) [10]	Iran	Believed to treat colic and trigger early passage of meconium after birth	Rock ground into a powder and mixed with honey and butter
Daw tway, gaw mo dah[11]	Burma	General infant remedy believed to treat digestive symptoms	Brown pellets taken orally or topically

Kajal, kohl, and surma[12-13]	Afghanistan, India, Pakistan	Believed to improve eyesight, protect the syes, and/or prevent the evil eye.	Black powder mixed into a liquid and applied to eyebrow or periorbitally
Litargirio[14]	Dominican Republic	Used as a deodorant/antiperspirant, or as a burn or fungal (usually foot) treatment treatment of burns and fungal infections of the feet	Yellow or peach- colored powder applied to the skin
Lozeena[15]	Iraq	Flavoring	Bright orange spice added to foods for flavor, particularly rice and meat dishes
Pay-loo-ah[16]	Southeast Asia	Treatment believed to treat fever and rash	Orange-red colored powder administered by itself or mixed in tea
Select Ayurvedic preparations[17-18]	India	Treatment for wide range of ailments	Preparations vary in appearance and how they are administered
Tamarind candies (and packaging)[19-20]	Mexico	Candies often consumed by young children	Candy often brought by visiting family members, sold by ethnic markets (embargoed in California), and available through itinerant vendors. "Bolirindo" lollipops by Dulmex™ are soft and dark brown. Candied jams ar typically packaged in ceramic jars.
Tiro (tozali and kwalli)[21]	Nigeria	Eye cosmetic used to improve vision or ward off the evil eye	Fine powder often applied to the eyelid

Mobile infants and young children are particularly at risk for lead exposure given their tendency to mouth objects, and often have increased contact with dust, dirt, and surfaces potentially contaminated with lead[1]. This tendency for mouthing, as well as ingesting non-nutritive substances (pica)

contaminated with lead, is exacerbated by lead's sweet taste. Infants and young children are predisposed to increased BLL at lower exposure levels because they have a greater ratio of body surface area to mass than adults [1,22]. Malnourished children may also be at an increased risk for harm from lead exposure if their BLLs are at or above the BLRV of 3.5 µg/dL, likely through increased intestinal lead absorption mediated by micronutrient deficiencies such as iron, calcium, or zinc [23,24].

The studies summarized below were conducted when the BLRV was 5 µg/dL. In October 2021, CDC updated the BLRV to 3.5 µg/dL. In one analysis of lead exposures in children <2 years of age (n=642) in a refugee camp in Thailand, moderate to severe anemia (hemoglobin <10 g/dL) was associated with BLL at or above 5 µg/dL; lead acid car batteries and traditional remedies were the most common sources of exposure [3]. Mouthing of cosmetic products was also a suspected contributor [3]. Certain subpopulations of women are also at increased risk for lead exposure; these include refugees and other recent immigrants. In one study, foreign-born pregnant women in New York City were 8.2 times more likely than non-foreign-born women to have a BLL at or above 5 µg/dL [25]. Among the groups studied, women from Bangladesh, Mexico, and Pakistan had the highest BLLs [25].

Refugee children arriving in the United States have higher average rates of BLLs exceeding the BLRV than US-born children. Analyses of domestic data have revealed that the prevalence of a BLL at or above 5 µg/dL among newly arrived refugee children may be in excess of 40% in certain groups [11, 26-30]. These reports suggest that country of origin, country of last residence, and age are strong predictors of BLLs at or above 5 µg/dL among newly arrived refugee children [30, 31]. In a recent assessment of refugee children 6 months to 16 years of age (n=27,284) resettled in 11 states (CO, ID, IL, KY, MA, MN, NC, NY [excluding New York City], TX, UT, and WA) and one county (Marion County, IN), the prevalence of BLL at or above 5 µg/dL at the initial domestic screening was 19.3% (n=5,275) [22]. BLL at or above 5 µg/dL was associated with younger age. Of those screened, 22.8% of children <7 years of age had BLLs at or above 5 µg/dL, while 16.5% of children ≥7 years of age had BLLs at or above 5 µg/dL. Of note, BLL at or above 5 µg/dL was higher in children examined in India, Afghanistan, Burma, and Nepal, as well as male children [22].

Refugee children are at continued risk for ongoing lead exposures after arrival in the United States. One analysis of lead exposure among refugee children (n=705) 0–16 years of age in Syracuse, NY, found that 17% of refugee children had BLLs at or above 5 µg/dL (≥5 µg/dL) upon initial screening [33]. Of those who had BLLs at or above 5 µg/dL at initial screening, and 30% were found to have an increased BLL at follow-up [33]. Among 1,121 refugee children (6 months–16 years of age) resettled in five jurisdictions (CO, IL, IN [Marion County], MN, and NY) who had both initial and follow-up lead screening results (3–6 months after initial screening), 183 (16.3%) had a BLL at or above 5 µg/dL at the initial and follow-up screening [22].

Additionally, 71 (6.3%) children had a BLL at or above 5 µg/dL at follow-up but had a BLL <5 µg/dL at the initial screening [22]. Although increases in BLL were more common in younger children, data suggest that older children (including adolescents) are also at risk for increases in BLL after resettlement to the United States [22]. Most often, lead exposures among children with new or increasing BLL after arrival include lead-based paints in older housing and lead-contaminated soil where children reportedly play [34]. Furthermore, certain behaviors, such as pica (e.g., eating soil or paint chips); picking or handling of loose contaminated paint chips, plaster, or putty; or chewing on contaminated painted surfaces can be sources of lead exposure [34]. Children, as well as adults, may also be at risk for BLL at or above the BLRV after arrival due to continued use of spices, candy, traditional cosmetic products, and cookware brought from overseas [35, 36]. Some of these products may also be purchased in the United States.

CLINICAL PRESENTATION

Children

Scientific evidence has shown that BLLs <10 µg/dL are associated with adverse cognitive and behavioral development [38]. At higher BLLs, acute symptoms of toxicity may appear. Above 40 µg/dL, children may experience headaches, abdominal pain, anorexia, constipation, clumsiness, agitation, and lethargy [38]. At 70 µg/dL, children may develop severe neurological complications, including seizures, ataxia, mental status changes, coma, and death [24]. Although severe poisoning is rare in the United States, the death of a newly arrived 2-year-old Sudanese refugee with a BLL of 391 µg/dL in 2000—which was the first lead-poisoning-related death in the United States in a 10-year period—underscores the importance of early identification and management of cases in children with BLL at or above the BLRV in resettled refugee children [39].

Pregnant and Lactating Women and Adolescent Girls

Lead exposure (and associated toxicity) remains a public health concern for certain groups of women and girls of childbearing age (15–44 years), developing fetuses, and nursing infants [40]. Lead toxicity in pregnant women has been associated with an increased risk of spontaneous abortion, gestational hypertension, abnormal fetal neurodevelopment, and low birthweight. Additionally, strong evidence shows that prenatal lead exposure impairs children's neurodevelopment, placing them at increased risk for developmental delay, reduced IQ, and behavioral problems [40]. Because more than 90% of lead is stored in bone, it is thought that long-term exposure in women may cause lead accumulated in bone to be released during times of higher metabolism, such as pregnancy and lactation, potentially placing the fetus or nursing infant at risk of exposure [40].

RECOMMENDATIONS FOR POST-ARRIVAL LEAD SCREENING

All refugee infants and children 0–16 years of age should be evaluated for lead exposure with a blood lead test. Older refugee adolescents should be tested if there is a high suspicion or clinical signs/symptoms of lead exposure, or if currently pregnant or lactating. A history of lead exposure includes questions about signs and symptoms (e.g., developmental history), behaviors (e.g., pica), and potential exposures such as use of cosmetics (purchased overseas), ceramics, spices, food, tobacco, or remedies [14, 15, 21]. An in-depth discussion of the clinical management of BLLs at or above the BLRV is beyond the scope of this document. Refer to Recommended Actions Based on Blood Lead Level | Childhood Lead Poisoning Prevention | CDC for additional guidance.

Standard Surveillance Definitions and Classifications

Please refer to the About the Data: Blood Lead Surveillance | Childhood Lead Poisoning Prevention | CDC and Data and Statistics | Childhood Lead Poisoning Prevention | CDC for additional information.

Pediatric Recommendations

Given the neurodevelopmental and health complications associated with exposure to lead, all refugee infants and children ≤16 years of age should be evaluated for lead exposure at the domestic medical screening visit with a blood test. Adolescent refugees >16 years of age should be tested if there is a high index of suspicion (e.g., sibling with BLL at or above 3.5 µg/dL, environmental exposure risk factors), if there are clinical signs or symptoms of lead exposure, or if pregnant or lactating. Venous or capillary lead levels should be reported to state or local lead programs. Clinicians may refer to the CDC Summary

of Recommendations for Follow-up and Case Management of Children Based on Confirmed Blood Lead Levels for additional information.

Within 3–6 months after initial testing, a blood lead test should be repeated for all refugee infants and children ≤6 years of age, . Repeat testing is also recommended for refugee children and adolescents 7-16 years of age who had EBLL at initial screening. Repeat testing is also warranted in adolescents >16 years of age with specific risk factors (e.g., sibling with EBLL, environmental risk factors). Additional information on case management and follow-up of EBLL is available in Managing elevated blood lead levels among young children : recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention (cdc.gov) [PDF – 152 pages]. Clinicians should also familiarize themselves with local lead resources, as well as state or local recommendations for treatment and prevention.

Recommendations for Pregnant and Lactating Women and Adolescent Girls
CDC does not recommend routine universal screening for BLLs for all pregnant or lactating women and adolescent girls in the United States. However, a risk evaluation of every pregnant or lactating girl or woman is encouraged, with screening recommended when one or more risk factors is identified [41]. Common risk factors for lead exposure in pregnant women and girls include pica behaviors, occupational exposure, use of traditional remedies or supplements, cosmetics manufactured overseas, use of traditional lead-glazed pottery, and nutritional status (e.g., low body mass index [BMI]) [40]. Importantly, recent emigration from or residency in areas where ambient lead contamination is high is an indication for screening [41]. Because refugees generally have lived in areas where ambient lead exposure is high, it is recommended that all newly arriving pregnant or breastfeeding girls and women be screened for lead exposure at the domestic medical screening with a blood test. Follow-up blood lead testing is recommended for those whose BLL is at or above 5 µg/dL upon initial screening. However, repeat testing (within 3-6 months of initial screening) should be considered in pregnant or lactating adolescents (<18 years of age) who had BLLs at or above 3.5 µg/dL at initial screening. Frequency of follow-up and actions taken are dependent on the BLL (see Table 1 in the ACOG Committee Opinion on Lead Screening during Pregnancy and Lactation). The provider should recommend a prenatal vitamin or multivitamin with adequate iron and calcium to pregnant or lactating girls and women [41]. Clinicians should consider a referral to a local health care provider with expertise in high-risk lead exposure or consult a high-risk Obstetrician provider for treatment and management. Those with a confirmed BLL at or above the BLRV should be reported as determined by local policies. Children in the household should also be tested for BLL. For interpretation of lead levels in pregnant and lactating girls and women, refer to the ACOG . Additional information on case management and follow-up of an elevated BLL in pregnant and lactating girls and women is available from the Guidelines for the identification and management of lead exposure in pregnant and lactating women (cdc.gov) [PDF – 303 pages].

ADDITIONAL RESOURCES
About Childhood Lead Poisoning Prevention | Childhood Lead Poisoning Prevention | CDC
State and Local Programs | Childhood Lead Poisoning Prevention | CDC

PDF version:
Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees (cdc.gov)

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Appendix H: Lead and Pregnancy Resources

1. Last Name	First Name	MI

2. Patient Number									

3. Date of Birth (MM/DD/YYYY)									
	Month		Day		Year				

4. Race ☐ American Indian or Alaska Native ☐ Asian
☐ Black/African American ☐ Native Hawaiian/Other Pacifi Islander
☐ Unknown ☐ White

5. Ethnic Origin ☐ Hispanic Cuban ☐ Hispanic Mexican American
☐ Hispanic Other ☐ Hispanic Puerto Rican
☐ Not Hispanic/Latino ☐ Unreported

6. Gender ☐ Female ☐ Male

7. County of Residence

N.C. Department of Health and Human Services
Division of Public Health
Women, Infant, and Community Wellness Section

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. Have you ever had a high blood lead level?	☐ YES	☐ NO	☐ UNSURE
2. Have you spent any time outside of the United States in the past 12 months? If yes: Where?	☐ YES	☐ NO	☐ UNSURE
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	☐ NO	☐ UNSURE
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	☐ NO	☐ UNSURE
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 ☐ YES	☐ NO ☐ NO	☐ UNSURE ☐ UNSURE
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	☐ NO	☐ UNSURE
7. Based on the results of a laboratory test, have you been told there's lead in your home's water?	☐ YES	☐ NO	☐ UNSURE
8. Have any of your children had an elevated blood lead level (>5 µg/dL)?	☐ YES	☐ NO	☐ UNSURE

Date: _____

_____

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.

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: https://wicws.dph.ncdhhs.gov/provPart/forms.htm

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

Dpartamento de salud y servicios humanos de Carolina del Norte
División de salud pública
Sección de Mujeres, Bebés y Bienestar Comunitario

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. Have you ever had a high blood lead level? **¿Ha tenido usted alguna vez niveles de plomo altos en la sangre?**	☐ YES ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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, especies, 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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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 pre gunta #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)** ☐ **b)** ☐ ☐ **Sí** **a)** ☐ **b)** ☐	☐ NO **a)** ☐ **b)** ☐ ☐ **No** **a)** ☐ **b)** ☐	☐ UNSURE **a)** ☐ **b)** ☐ ☐ **No sabe** **a)** ☐ **b)** ☐
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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**
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 ☐ **Sí**	☐ NO ☐ **No**	☐ UNSURE ☐ **No sabe**

Date/Fecha_____

DHHS 4116S (09/2022) | WICWS Review (09/2025)

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: https://wicws.dph.ncdhhs.gov/provpart/forms.htm

DHHS 4116S (09/2022) | WICWS Review (09/2025

☐ Acceptance Criteria Not Met
Reason:_____
Date: _____ Initials:_____

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

First MI

[2] Address

Address

City

Attach Approved Printed Label Below

[3] County State Zip Code

[4] Local Pt. ID SSN - - [5] Date of Birth (MM/DD/CCYY) / /

[6] Medicaid Client ☐ Yes ☐ No
If yes, enter #

[7] Dx Code/ ICD

[8] Race (mark all that apply)
☐ White ☐ American Indian/Alaska Native
☐ Black ☐ Native Hawaiian/Pacific Isles
☐ Asian ☐ Unknown

[9] Ethnicity
☐ Hispanic
☐ Non-Hispanic
☐ Unknown

[10] Sex
☐ Male
☐ Female

[11] Other (mark all that apply)
☐ Refugee (up to 16 years of age, see definition below)
☐ Child (up to 6 years of age)
☐ Prenatal
☐ WIC Patient

Specimen

[12] ESSENTIAL SPECIMEN DATA

Date Collected (MM/DD/CCYY) / /

☐ Microtainer ☐ Initial blood lead test
☐ Venous ☐ Follow-up blood lead test

[13] EIN / Federal Tax Number

-

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

NPI Number

Ordering Provider Last Name

LAB

Lab Use Only

Bar Code

☐ Specimen Missing
☐ Submitter info not provided
Unsat Code_____

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

.State Laboratory of Public Health (Revised 08/2022) For more information, refer to website at http://slph.dph.ncdhhs.gov 6970050287

Sample Template Policy/Procedure/Protocol for Local Health Departments
Lead and Pregnancy Risk

Reviewed: Under review

Purpose: This policy is intended to assure that all pregnant women who reside in _____ County and seek health care from the _____ County Health Department, will be offered screening for lead exposure-and if appropriate, blood lead testing- 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 CDC recommendations 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 by emailing neasha_graves@unc.edu for bulk 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 accordingly.
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.dph.ncdhhs.gov/celr-user. The NCSLPH will call the provider on record if the blood lead level (BLL) result is ≥ 5.00 µg/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 (µg/dL)**.
8. If the results are ≥ 5.00 µg/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 µg/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 a patient has 2 consecutive venous blood lead test results ≥ 5.00 µg/dL within a 12-month period, the provider should 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) 707-5854 or toll free at (888) 251-5543.
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.

FOLLOW-UP SCHEDULE FOR PREGNANCY

Initial Blood Lead Level (BLL) Results	Frequency of Follow-Up Testing	Recommended Interventions According to BLL in Pregnancy
< 5 µg/dL	• No diagnostic or follow-up testing necessary	• Educate on lead exposure sources and risk reduction
5-9 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing every 3 months for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL • **Alert baby's health care provider to maternal elevated blood lead level. Collect an umbilical cord blood sample or neonatal sample prior to discharge to establish a baseline level for the newborn. Neonatal samples can be venous or capillary (heel stick).**	Above actions in addition to: • Provide case management • Refer case to local health department to offer an environmental investigation • 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 Poisoning Can Be Prevented: Some Do's and Don'ts" (2 sided) and "Keeping Lead at Work and Preventing Take Home Exposure" • If appropriate for occupation, encourage wearing a clean/well-fitted respirator • Consider contacting the employer about assistance with safe work practices
10-24 µg/dL	• Conduct diagnostic testing within 1 month • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • Recommend removal from workplace lead exposure
25-44 µg/dL	• Conduct diagnostic test within 1-4 weeks • Conduct follow-up testing monthly for the duration of the pregnancy until 2 consecutive BLLs are < 5.00 µg/dL	Above actions in addition to: • **Advise not to breastfeed and discard breastmilk if BLL ≥ 40 µg/dL** • Testing milk is not recommended
≥ 45 µg/dL	• Conduct diagnostic test within 24 hours • Conduct follow-up testing at frequent intervals for the duration of the pregnancy depending on clinical interventions and trend in BLLs • Should be considered and treated as high-risk pregnancy • Patient may require having care transferred to a high-risk obstetrical practice	Above actions in addition to: • Consult or transfer to a provider specializing in lead poisoning therapy before considering chelation for the patient

FOLLOW-UP SCHEDULE FOR BREASTFEEDING

Initial Blood Lead Level (BLL) Results	Frequency of Follow-Up Testing
5-19 µg/dL	• Every 3 months, unless infant blood lead levels are rising or fail to decline.
20-39 µg/dL	• Maternal BLL 2 weeks postpartum and then at 1 to 3-month intervals depending on trend in infant BLLs
≥ 40µg/dL	• 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.**

CONTACTS:

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

For clinical questions regarding testing in pregnancy contact: Ashley Stacy-Boddapati, Nurse Consultant, Children's Environmental Health Branch, Division of Public Health at 919-609-0877.

For occupational health advice contact: Karin Evanoff, Nurse Consultant, Occupational and Environmental Epidemiology Branch, Division of Public Health at 919-707-5900.

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://stacks.cdc.gov/view/cdc/147837

Division of Public Health, *Maternal Health Agreement Addendum*
101_Maternal Health_FY23_Final.pdf (ncdhhs.gov)

Educational Materials and Resources:

Please refer to **Appendix E- Educational and Outreach Materials** for a list of printable resources. These materials are also available at https://nchealthyhomes.com/lead-poisoning/.

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 (≥ 5 µg/dL) within a 12-month period.

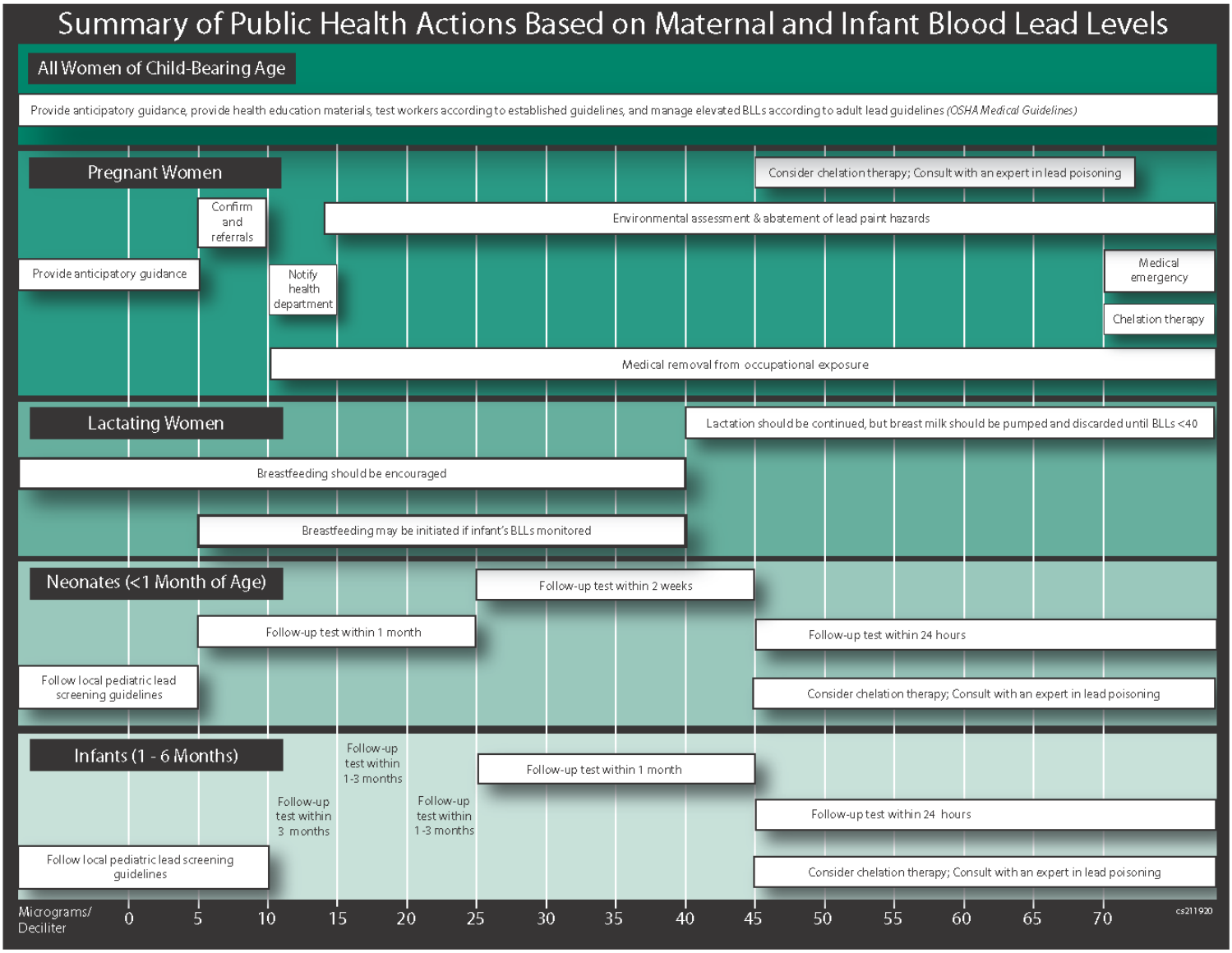
Referral Date:_____Referred by: _____

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? ☐ Yes ☐ 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 (µg/dL):	Venous (only)
Analyzing laboratory name:	Laboratory address:	Phone #:
BLOOD LEAD TEST INFORMATION: DIAGNOSTIC/ CONFIRMATORY TEST #2		
Date collected:	Blood Lead Level (µg/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:

Version 12/15/17



Source: https://wicws.dph.ncdhhs.gov/Manuals/SummaryChart-clinics.pdf

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: Guide to 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 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 attachments you have attached to the event.

Appendix J: Other Resources

Steps for Collecting Fingerstick Blood Samples in Micro-Vials for Lead Testing

Place all collection materials on top of disposable pad. Open the lancet, alcohol swabs, gauze, bandage, and other items. Have all items ready for blood collection.

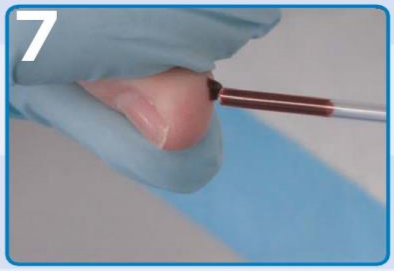
Wash the patient's hands thoroughly with soap and water. Allow them to air dry without touching any surface. Do not use paper towels to dry the patient's hands. Put on your powder free gloves.

Massage the patient's hand and lower part of the finger to increase blood flow. Turn the hand down.

Scrub the patient's middle finger or ring finger with an alcohol swab.

Hold the finger in a downward position and lance the palm side surface of the finger.

Apply slight pressure to start blood flow. Blot the first drop of blood on a gauze pad without touching the finger and discard the gauze in appropriate container.



Keep the finger in a downward position to maintain blood flow. Hold the micro-collection tube at an angle of 10 degrees below the collection site and touch the tapered end of the tube into the droplet of blood. Do not touch the skin with the tube. Fill the micro-collection vial with the appropriate amount of blood as defined by the micro-collection container that you are using.

Once you have collected enough blood, apply a slight pressure to the finger to stop the bleeding. Apply a sterile adhesive bandage over the puncture site.

Seal the specimen container and, inverting it immediately, gently invert container 7-10 times to prevent clots from forming.

Place the label on the vial. If the label contains a barcode, the barcode needs to be vertical like a ladder when placed on the vial. If the barcode is not vertical, the laboratory will not be able to read the label. Properly discard all used materials. Contact the laboratory for storage and transport guidance.

For more information visit
www.cdc.gov

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Lead in Spices, Herbal Remedies, and Ceremonial Powders Sampled from Home Investigations for Children with Elevated Blood Lead Levels — North Carolina, 2011–2018

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The number of pediatric cases of elevated blood lead levels (BLLs) are decreasing in North Carolina. However, one county reported an increase in the number of children with confirmed BLLs ≥5 μg/dL (CDC reference value, https://www.cdc.gov/nceh/lead/acclpp/blood_lead_levels.htm), from 27 in 2013 to 44 in 2017. Many children with elevated BLLs in this county lived in new housing, but samples of spices, herbal remedies, and ceremonial powders from their homes contained high levels of lead. Children with chronic lead exposure might suffer developmental delays and behavioral problems (https://www.cdc.gov/nceh/lead/). In 1978, lead was banned from house paint in the United States (*1*); however, children might consume spices and herbal remedies daily. To describe the problem of lead in spices, herbal remedies, and ceremonial powders, the North Carolina Childhood Lead Poisoning Prevention Program (NCCLPPP) retrospectively examined properties where spices, herbal remedies, and ceremonial powders were sampled that were investigated during January 2011–January 2018, in response to confirmed elevated BLLs among children. NCCLPPP identified 59 properties (6.0% of all 983 properties where home lead investigations had been conducted) that were investigated in response to elevated BLLs in 61 children. More than one fourth (28.8%) of the spices, herbal remedies, and ceremonial powders sampled from these homes contained ≥1 mg/kg lead. NCCLPPP developed a survey to measure child-specific consumption of these products and record product details for reporting to the Food and Drug Administration (FDA). Lead contamination of spices, herbal remedies, and ceremonial powders might represent an important route of childhood lead exposure, highlighting the need to increase product safety. Setting a national maximum allowable limit for lead in spices and herbal remedies might further reduce the risk for lead exposure from these substances.

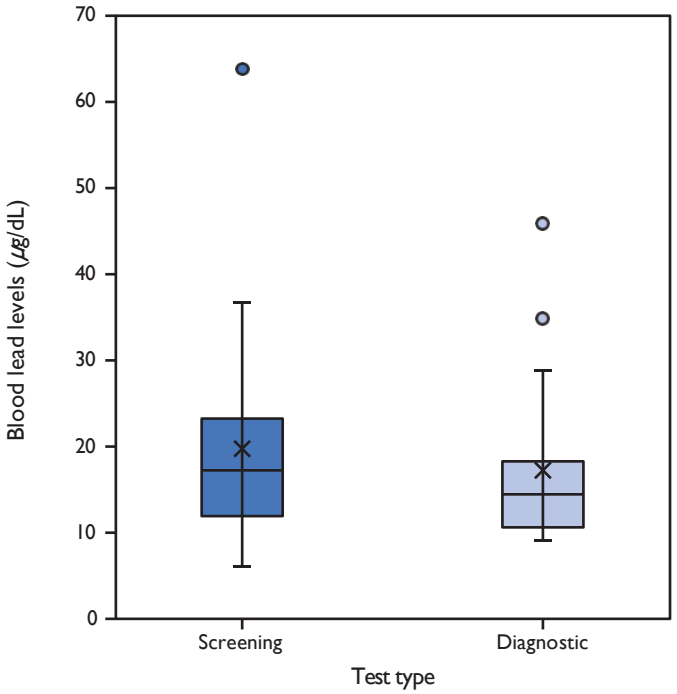
All BLLs for North Carolina children aged <6 years are required to be reported to NCCLPPP, along with demographic data including race and Hispanic ethnicity of the child. Approximately 51% of North Carolina children are tested during routine well child visits at age 1 or 2 years. Diagnostic testing of a second (preferably venous) blood specimen at a reference laboratory is required to confirm all BLLs ≥5 μg/dL. Since July 1, 2017, a confirmed elevated BLL has been defined in North Carolina as two consecutive test results ≥5 μg/dL within a 12-month period; previously, a confirmed elevated BLL was defined as two consecutive test results ≥10 μg/dL within a 6-month period.*

Lead investigators from state and local health departments offer free home investigations for children with confirmed elevated BLLs. Because of the lag time between the initial and diagnostic specimen collection and laboratory result reporting, investigations might be scheduled several months after the initial BLL specimen was collected. During January 2011–January 2018, home lead investigations were conducted at 983 properties in North Carolina. Lead investigators collected information on when the home was built, documented any evidence of lead in the home, and submitted environmental samples of lead paint, water, soil, consumer products, and foods to the North Carolina State Laboratory of Public Health for chemical analysis. All spice, herbal remedy, and ceremonial powder samples were screened for lead with an atomic absorption mass spectrometer by the North Carolina State Laboratory of Public Health; starting in 2011, samples with <15 mg/kg of lead were subsequently analyzed using an inductively coupled plasma mass spectrometer. Lead investigators entered investigation reports and environmental sample data into the North Carolina childhood lead surveillance system and linked investigations to the children's blood lead test results.

For the environmental samples tested, results below the limit of detection (LOD) were replaced by LOD divided by √2, an extrapolation technique with low error rates (*2*). Blood lead test results below LOD were standardized to 1 μg/dL. Because information about consumption was not collected for most children, descriptive statistics were calculated for the environmental sample results separately from the child blood lead data. The data analysis and figures for this paper were generated using statistical software.

Among the 61 children included in this report, the average screening (initial) BLL was 17.0 (±9.6) μg/dL (Figure), and the average diagnostic BLL was 15.2 (±7.0) μg/dL. Diagnostic BLLs were drawn between February 28, 2011, and December 5, 2017. The average age of the children at the time of the lead investigation was 2.3 years (range = 0.9 to 6.6 years); investigations for these children were conducted from March 17, 2011, to January 26, 2018.

FIGURE. Screening and diagnostic* blood lead levels in children (n = 61) exposed to lead-contaminated spices, ceremonial powders, or herbal remedies — North Carolina, 2011–2017



* Box plots illustrate the distributions of screening (initial) and diagnostic (confirmatory) blood lead levels. The tops of the boxes represent the 75th percentile and the bottoms the 25th percentile. The middle line of the box is the median. X represents the mean. Circles represent outliers. Whiskers indicate the standard deviations.

Information on race was available for 58 (95%) children. Among those with known race, 41 children (67.2%) were identified as Asian (including those of Indian and Pakistani descent); nine children (13%) were identified as black or African American (including two siblings born in West Africa). Among eight children identified as white, one was from Afghanistan. Among 51 children (84%) for whom Hispanic ethnicity was known, seven (11.5%) were Hispanic.

The 59 properties investigated were in eight primarily urban counties; 42 properties (71%) were built after 1978. Among these 42 newer residences, 10 had brass objects, jewelry, cookware, and other consumer items that might have contained lead; 32 (76%) had no evidence of lead in paint, dust, mini-blinds, faucets, bathtub glaze, or furniture finish. In seven of these 32 properties, spices, herbal remedies, and ceremonial powders were the only identified risk.

A total of 392 samples of spices, herbal remedies, and ceremonial powders were collected from the 59 properties. Six sample results were excluded because of different sampling and analysis methods. Among the remaining 386 samples included in this report, 344 (89%) were items intended for consumption (food), including spices and herbal remedies; and 42 (11%) were items not intended for consumption (nonfood), including ceremonial powders. Mean lead levels of ≥1 mg/kg were identified in 50 product categories, including 10 nonfood categories and 40 food categories. Among 177 samples included in these 50 product categories, 111 (62.7 %) individual samples were contaminated with ≥1 mg/kg lead, including 76 (22.0%) food items and 35 (83.3%) nonfood items (Table). These 111 contaminated samples represent 28.8% of the 386 samples included. Among nonfood items (ceremonial powders and topical remedies), the highest average lead levels were detected in kumkum (average = 12,185 mg/kg; range = 0.4–140,000), sindoor (average = 41,401 mg/kg; range = 0.1–130,000), and surma (average = 68,000 mg/kg; only one sample collected). Among edible items, saffron supplement (average = 2,764 mg/kg; only one sample collected), Balguti Kesaria (an Ayurvedic medicine) (average = 220 mg/kg; only one sample collected), and turmeric (average = 66 mg/kg; range = 0.1–740) had the highest average lead levels. Country of purchase was recorded for 187 (48%) of the 386 samples; therefore, product origin is largely unknown. Among samples with known origin, 142 (76%) were purchased in the United States.

Discussion

Lead can contaminate spices during many points in the global supply chain. Spices are often grown in countries polluted by leaded gasoline, smelters, battery manufacturing plants, and mines. Lead is deposited in soil and water from airborne pollutants and fertilizer application. Lead dust from grinding machinery can also contaminate spices (*3*). Spices might also be adulterated deliberately with lead to enhance color or increase weight.† Because >95% of spices consumed in the United States are imported,§ recommendations to purchase only locally grown spices are impractical. According to the World Health Organization Codex Standard 193–1995, the permissible limit of lead for infant formula is 0.02 mg/kg lead and for salt is 2 mg/kg. No U.S. permissible limit for lead in spices exists; however, the FDA limit for lead in natural-source food color additives (e.g., paprika, saffron, and turmeric) is 10 mg/kg. The FDA action levels (i.e., the levels at which an investigation is undertaken, or a recall is issued, depending upon the circumstances and findings) for products intended for consumption by children are 0.1 mg/kg for candy and 0.5 mg/kg for other foods¶; however, spices are not considered food intended for consumption by children. The Environmental Protection Agency estimates of consumption

† https://www.astaspice.org/the-american-spice-trade-associations-statement-on- lead-in-turmeric/

§ https://www.ers.usda.gov/data-products/chartgallery/gallery/chart-detail/?chartId=58398

¶ https://www.fda.gov/food/foodborneillnesscontaminants/metals/ucm172050.htm

TABLE. Categories of spices, herbal remedies, and ceremonial powders (N = 177) with average lead level ≥1 mg/kg sampled during lead investigations — North Carolina, 2011–2018

Product category	No. of samples	Average lead level, mg/kg (SD)	Range, mg/kg
Nonfood items			
Ash powder	1	19.0 (N/A)	N/A
Incense	4	7.0 (6.6)	1.9–15.7
Kum kum (powder made from turmeric or other materials, used for social and religious markings in India)	12	12,185.2 (40,276.5)	0.4–140,000.0
Pooja powder (used in Hindu religious worship)	1	65.0 (N/A)	N/A
Rangoli (colored powders used to make designs)	2	2.9 (1.8)	1.6–4.2
Sandal scented pooja powder	2	4.2 (1.6)	3.0–5.3
Sandalwood (chandan) powder	3	8.4 (9.2)	3.0–19.0
Sindoor (traditional red cosmetic powder)	8	41,401.1 (58,540.7)	0.1–130,000.0
Surma (an ore ground into powder, used as an eye cosmetic)	1	68,000.0 (N/A)	N/A
Vibhuti (ash made from burnt dried wood, applied to the skin in religious rituals)	3	80.3 (70.2)	2.9–140.0

from the What We Eat in America survey are low for many of the spices in question (e.g., 0.09 g/day of cumin, 0.03 g/day of turmeric) (*4*); however, spice consumption might differ for children whose parents emigrated from Southeast Asia (e.g., estimated consumption: 1.22 ± 1.14 g per portion of cumin in dishes prepared daily; 0.60 ± 0.46 g per portion of turmeric in dishes prepared daily), where spices are used in cooking, home remedies, and ceremonial activities (*5*). Use of spices, herbal remedies, and alternative medicines also are increasingly popular among other U.S. residents; spice imports into the United States have increased by approximately 50% since 1998 (*6*). However, their regulation is complicated by Internet sales, international travel, and importation by relatives and friends (*7*).

A large proportion of ceremonial powders, spices, and herbal remedies found during home investigations for children with elevated BLLs in North Carolina were contaminated with lead. Spices and herbal remedies are meant for consumption, used to enhance food flavor and color, and are administered medicinally to persons of all ages. Lead investigators reported that spices and herbal remedies are used by both recent immigrants and U.S.-born children. Although ceremonial powders are not food, they might be accidentally ingested by children. Most previous reports of childhood lead poisoning from spices are case reports (*7*,*8*). This study includes approximately 7 years of data, environmental investigation results, and clinical findings from 61 children for whom these substances were a suspected source of lead exposure.

TABLE. (*Continued*) Categories of spices, herbal remedies, and ceremonial powders (N = 177) with average lead level ≥1 mg/kg sampled during lead investigations — North Carolina, 2011–2018

Product category	No. of samples	Average lead level, mg/kg (SD)	Range, mg/kg
Food items			
Spices and condiments			
Anise	4	1.7 (1.9)	0.3–4.4
Bay leaves	1	2.6 (N/A)	N/A
Black seeds	1	2.6 (N/A)	N/A
Cardamom	1	1.4 (N/A)	N/A
Chaat masala	1	1.5 (N/A)	N/A
Chili garlic sauce	1	4.0 (N/A)	N/A
Chili powder/Red pepper	23	12.6 (41.2)	0.1–170.0
Cinnamon	2	2.6 (0.1)	2.5–2.7
Cloves	1	1.4 (N/A)	N/A
Coriander	9	4.8 (12.8)	0.1–39.0
Cumin	17	1.1 (1.5)	0.1–6.4
Cumin and coriander mix	2	1.1 (0.5)	0.7-1.4
Curry leaf powder	1	1.4 (N/A)	N/A
Curry powder	2	1.4 (1.7)	0.2-2.6
Dagad phool (stone flower)	1	2.8 (N/A)	N/A
Fenugreek	1	1.4 (N/A)	N/A
Ginger	3	1.0 (0.5)	0.7–1.6
Lemon powder	1	6.5 (N/A)	N/A
Kabsa spice	1	19.0 (N/A)	N/A
Mint	1	2.0 (N/A)	N/A
Rosemary	1	1.6 (N/A)	N/A
Saffron	2	1.2 (1.4)	0.2–2.2
Shwarma spice	1	6.8 (N/A)	N/A
Spice mix (all purpose)	3	1.8 (2.6)	0.2–4.8
Turmeric	34	66.4 (206.6)	0.1–740.0
Vanilla	1	8.5 (N/A)	N/A
Medications, oils, and supplements			
Balguti Kesaria (Ayurvedic medicine)	1	220.0 (N/A)	N/A
Chamomile oil	1	8.2 (N/A)	N/A
Herbal remedy	1	8.2 (N/A)	N/A
Lime calcium powder	1	1.4 (N/A)	1.4
Nux vomica	1	10.6 (N/A)	N/A
Mojhat ceremonial drink	1	31.0 (N/A)	N/A
Saffron supplement	1	2,764.0 (N/A)	N/A
Prepared foods			
Candy	5	10.6 (14.0)	0.0–25.9
Milk cookie	1	1.4 (N/A)	N/A
Other food products			
Baby cereal	2	17.6 (23.2)	1.2–34.0
Cornstarch	2	5.4 (6. 6)	0.7–10.0
Rice flour	3	4.1 (5.7)	0.1–10.6
Rice with turmeric	1	1.4 (N/A)	N/A
Sugar	3	3.7 (6.0)	0.1–10.6

Abbreviations: N/A = not applicable; SD = standard deviation.

Because the level of detail reported on spice sample consumption and product origin was inconsistent among lead investigators, NCCLPPP created a survey tool to guide and encourage lead investigators to collect the details necessary for FDA reporting. This survey tool was piloted during home investigations in one North Carolina county. The survey also was tested for cultural sensitivity, administration time, and ease of understanding through focus groups with Hispanic and

Summary

What is already known about this topic?

No national limit exists for lead contamination in spices. Ingested lead is absorbed quickly by children and causes developmental delays.

What is added by this report?

A North Carolina study of lead content in spices, herbal remedies, and ceremonial powders in homes of children with elevated blood lead levels found that 28.8% of samples contained ≥1 mg/kg lead, suggesting contaminated products might represent an important source of childhood lead exposure. A survey instrument was created to collect information on product origin and consumption.

What are the implications for public health practice?

Spices and herbal remedies are increasingly part of U.S. children's diets and might be a source of lead exposure in children with elevated blood lead levels.

South Asian community members. The survey tool is available online in English** and Spanish.††

New York City, New York State, and California have created their own recall and alert protocols for contaminated products (*9*,*10*). NCCLPPP leads a quarterly, national workgroup to develop standardized protocols for product reporting and data and sample collection. To reduce the time for reporting to FDA, NCCLPPP added a new workflow to the North Carolina childhood lead surveillance system, which lists new lead poisoning cases from consumable items. If the spices or herbal remedies are purchased in the United States, the NCCLPPP epidemiologist will notify the FDA Consumer Safety Officer regional liaison of the findings. In 2017, FDA formed a Toxic Elements Working Group to focus on protecting consumers from heavy metals such as lead in food, cosmetics, and dietary supplements (https://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm604173.htm).

The findings in this report are subject to at least five limitations. First, spices are frequently purchased wholesale and removed from their original containers, so information regarding product origins and lot numbers might have been discarded. Second, many lead investigators did not collect spice and herbal remedy samples. The authors excluded 11 reports from the numerator but not the denominator of the analysis (all lead investigations since January 1, 2011), in which cultural products were not sampled, although they were suspected as a lead exposure hazard, so the number of cases with exposure to these products might be underestimated. Third, until recently, persons with BLLs confirmed between 5–9 μg/dL were only offered education and clinical management unless they lived in a county with a local ordinance triggering home investigation at lower levels than the state guidelines, which also may lead to an underestimation of cases. Fourth, although some individual specimens contained low detectable lead levels, the combined, chronic exposure to these products might increase BLLs in some children. Direct toxicologic modeling cannot be performed using these data because of the large amount of missing information regarding consumption. Finally, the small sample size and the large age range of children would make modeling the effects of these exposures difficult because the metabolism of lead and effect of lead on the development of an infant aged 1 year would be different from that for a child aged 5 years.

Lead poisoning prevention professionals should educate parents about the potential for lead exposure from spices, herbal remedies, and ceremonial powders by making educational materials available in several languages at festivals, places of worship, and other community centers. Keeping ceremonial powders out of reach of children can prevent their accidental consumption, and testing of children who consume spices or herbal remedies regularly might lead to earlier detection of elevated BLLs (https://www.cdc.gov/nceh/lead/tips/folkmedicine.htm). Lead investigators should sample these products during investigations and attempt to document product origin and level of consumption. Increasing testing of spices, herbal remedies, and ceremonial powders for heavy metals by food safety regulators at the port of entry when these substances are imported into the United States might reduce the occurrence of lead poisoning associated with these substances.§§ Because these products are sold nationwide, setting a national maximum allowable limit for lead in spices and herbal remedies might further reduce the risk for lead exposure from them.

§§ https://www.fda.gov/food/guidanceregulation/importsexports/importing/ and https://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm2006791.htm.

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** https://ehs.ncpublichealth.com/docs/forms/cehu/SpiceandHomeRemedySurveyFINAL-English.pdf.

†† https://ehs.ncpublichealth.com/docs/forms/cehu/SpiceandHomeRemedySurveyFINAL-Spanish.pdf.

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Childhood Lead Exposure Linked to Apple Cinnamon Fruit Puree Pouches — North Carolina, June 2023–January 2024

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Abstract

Lead exposure is toxic even at low levels, resulting in impairments that can affect a child's lifelong success. In North Carolina, testing for lead is encouraged for all children at ages 1 and 2 years and required for children covered by Medicaid; investigations are performed to identify potential exposure sources for children with blood lead levels (BLLs) ≥5 μg/dL. During June–August 2023, routine lead testing identified four asymptomatic North Carolina children with BLLs ≥5 μg/dL. Home investigations identified only WanaBana brand apple cinnamon fruit puree pouches as a potential exposure source; product samples contained 1.9–3.0 ppm of lead. An expanded nationwide investigation led to identification of approximately 500 cases of childhood lead exposure believed to be linked to consumption of apple cinnamon purees, including 22 cases in North Carolina. Fewer than one half (45%) of the 22 North Carolina cases were among children covered by Medicaid. A coordinated multiagency communication strategy was implemented in North Carolina to notify consumers of the hazard and provide recommendations for preventing further exposure. The Food and Drug Administration issued a nationwide public health advisory on October 28, 2023; 2 days later, the manufacturer issued a voluntary recall. Routine testing of young children for lead exposure, combined with thorough environmental investigations, can identify emerging sources of lead exposure and limit further harm.

Introduction

North Carolina encourages testing of all children for lead at ages 1 and 2 years and requires testing for children enrolled in Medicaid. All blood lead test results for children aged <6 years are reportable to the North Carolina Department of Health and Human Services (NCDHHS) Childhood Lead Poisoning Prevention Program (CLPPP) (*1*). A child aged <6 years with two consecutive capillary or venous blood lead levels (BLLs) ≥5 μg/dL within a 12-month period is considered to have a confirmed, reportable lead level and is eligible for a home investigation conducted by a registered environmental health specialist (field investigator) from the applicable county health department to identify the likely source of lead exposure.* When edible or consumer products are suspected as a source of lead exposure, environmental samples are collected from the home and analyzed by the North Carolina State Laboratory of Public Health (NCSLPH) Inorganic Chemistry Laboratory.† Edible or consumer products with lead levels above North Carolina's reportable limits (≥1.0 ppm for most spices and foods) are reported to the Food and Drug Administration (FDA). Medical providers of children with confirmed BLLs ≥5 μg/dL are advised to use the North Carolina Clinical Follow-Up Schedule§ to monitor the child's BLL and to provide additional case management as warranted. During June– August 2023, routine lead testing identified four asymptomatic children in three unrelated households with BLLs ≥5 μg/dL who are the focus of this report, triggering home investigations to identify and remove sources of exposure.

Investigation and Results

Household A

During June 2023, routine blood lead testing identified two siblings, aged 1 and 3 years, living in a western North Carolina county, each of whom had two consecutive BLLs ≥10 μg/dL within a 12-month period (Figure). An environmental inves- tigation conducted in July did not yield any potential sources as the likely cause of lead exposure. The field investigator

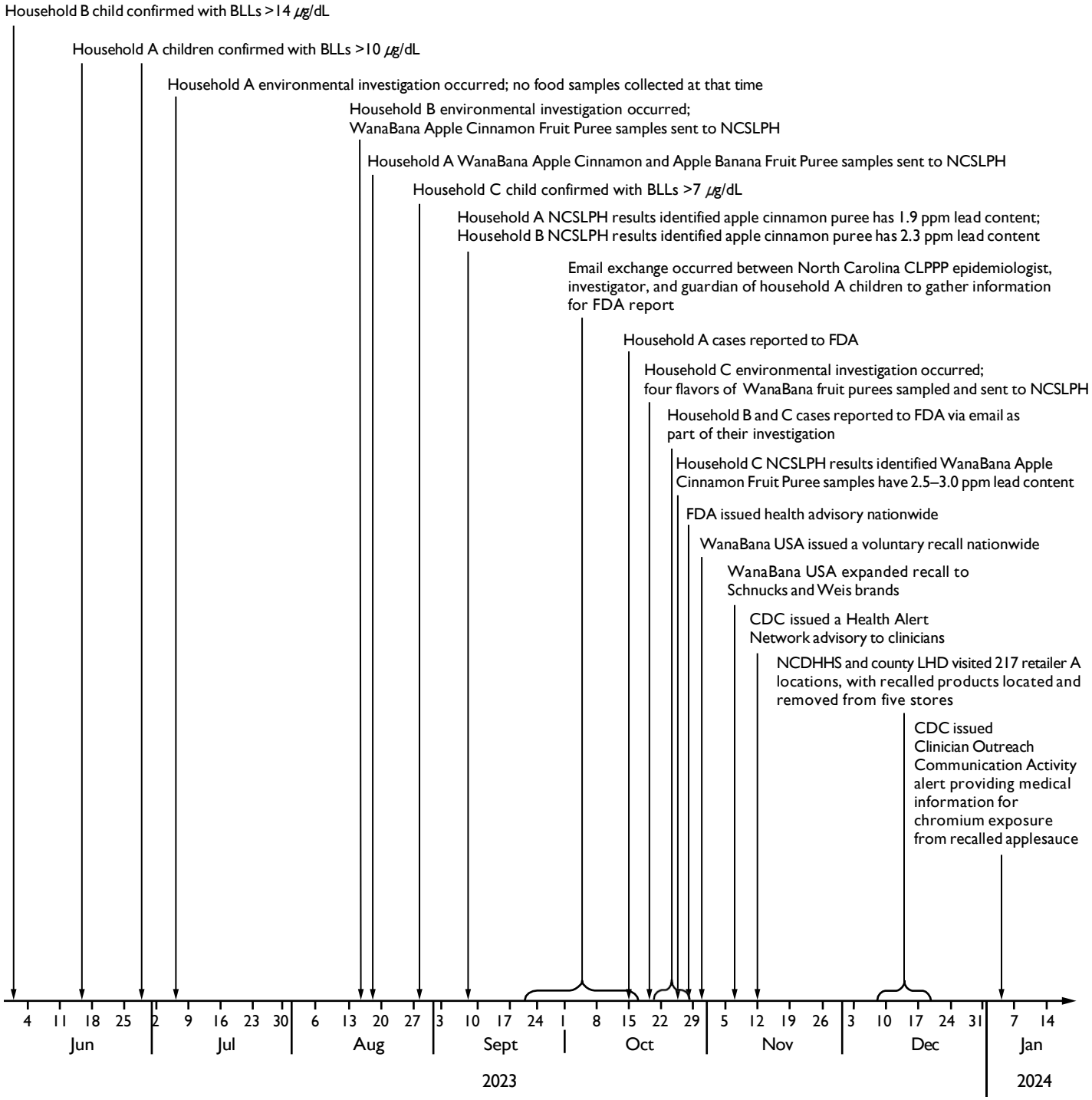
*An environmental investigation consists of visits to the home and potentially other addresses where the child regularly visits or spends time (defined by North Carolina General Statute Sect.130A–131.7[14]), such as child care facilities; the collection of water and environmental samples (dust, soil, and paint); and x-ray fluorescence analyzer readings in addition to an interview. The investigation usually concludes when the likely source is identified, which can take weeks of waiting for laboratory results or additional site visits.

https://www.ncleg.net/EnactedLegislation/Statutes/PDF/ByChapter/Chapter_130A.pdf#page=108

† NCSLPH provides essential laboratory support to CLPPP partners. This support is accomplished through the American Industrial Hygiene Association's Lead Assessment Program accredited testing of dust wipes, paint chips, and soil samples and through analytical screening of many other matrices, including spices, ceremonial powders, herbal remedies, cosmetics, toys, and foods. Food testing for lead is performed on inductively coupled plasma mass spectrometry instrumentation following Environmental Protection Agency method 6020B.

§ https://ehs.dph.ncdhhs.gov/hhccehb/cehu/lead/docs/ClinicalFollowUpSchedule_3.18.22.pdf

FIGURE. Response timeline* of an investigation of childhood lead exposure linked to consumption of WanaBana Apple Cinnamon Fruit Puree pouches — North Carolina, June 2023–January 2024



Abbreviations: BLLs = blood lead levels; CLPPP = Childhood Lead Poisoning Prevention Program; FDA = Food and Drug Administration; LHD = local health department; NCDHHS = North Carolina Department of Health and Human Services; NCSLPH = North Carolina State Laboratory of Public Health.

* Confirmation of the case is based on the date of the second consecutive BLLs ≥5 µg/dL. The order of the environmental investigations was based on when the site visit was conducted.

suspected that a food item commonly consumed by both children could be the source, because children aged 1 year and 3 years have different hand-to-mouth behavior, yet the siblings' BLLs rose simultaneously. On a food log, the parents recalled that both siblings ate WanaBana fruit puree pouches. In mid-August, the field investigator sent samples of apple cinnamon and apple banana flavor WanaBana fruit pouches taken from the home to the NCSLPH. Results obtained in September indicated that the apple cinnamon flavor contained 1.9 ppm lead[¶]; the North Carolina CLPPP was notified. On October 17, an initial report including laboratory results, packaging photos, lot numbers, and place of purchase (retailer A) was submitted to FDA.

Household B

During June 2023, a child aged 2 years living in a different western North Carolina county was identified through routine testing to have two consecutive BLLs >14 μg/dL. An environmental investigation conducted in mid-August by the same field investigator who conducted the household A investigation did not identify any potential sources as the likely cause of lead exposure. However, when asked about food or spice consumption, the child's parent mentioned that the child consumed applesauce pouches purchased from retailer A. A sample of WanaBana Apple Cinnamon Fruit Puree obtained from the home was sent to NCSLPH. In early September, NCSLPH reported that the sample contained 2.3 ppm lead.

Household C

During August 2023, a child aged 1 year living in a third western North Carolina county was identified through routine testing to have two consecutive BLLs ≥7 μg/dL. During preliminary interviews and water sample collection at the child's home in September, none of the usual property-related lead sources were identified. During a home investigation in mid-October, the field investigator administered North Carolina CLPPP's spice and home remedy survey.** The survey collects information that FDA requires to take public health action, including questions about spices, ceremonial powders, and alternative medicines, and is available in multiple languages. Using the survey, the investigator asked about consumption of cinnamon applesauce, which revealed that family members had purchased more than 90 pouches of four flavors of WanaBana fruit puree pouches for the child from three locations of retailer A in North Carolina and Kentucky.

While at the home, the field investigator contacted the NCSLPH Inorganic Chemistry Laboratory to develop a comprehensive sampling plan. This plan included testing whole, unopened pouches of four flavors (apple cinnamon, pineapple and banana, apple and banana, and mango and banana) found in the home and the pouch material. Water, soil, and dust samples were also submitted. On October 24, NCSLPH reported that three different lot numbers of the apple cinnamon product contained lead in concentrations ranging from 2.5 to 3.0 ppm.

Public Health Response

Initial Response and Health Advisory

After FDA was alerted on October 17 that lead had been detected in a food product from household A, North Carolina public health officials and FDA worked together with county health departments to determine whether other children might have been exposed. North Carolina public health officials provided FDA with additional laboratory test results and the results of environmental investigations from households A, B, and C, including where affected lots were purchased, and col- lected product to test from retailer A locations across the state. North Carolina public health agencies also collaborated with the North Carolina Department of Agriculture and Consumer Services (NCDACS) laboratory, which provided retail product analysis, confirming NCSLPH results. Within 2 weeks, FDA confirmed North Carolina's findings and issued a nationwide public health advisory. On October 28, North Carolina and FDA disseminated press releases urging consumers to dispose of contaminated products and contact their medical providers for testing (2,3). North Carolina public health officials notified all county health departments and the state's child care licensing agency of the advisory. In accordance with North Carolina protocol for reporting food sample results during field investigations, households A, B, and C were advised to discard the apple puree products based on the initial NCSLPH product testing results. Follow-up testing indicated that BLLs among the affected children declined, adding confidence that the source had been identified.

Voluntary Nationwide Product Recall

On October 30, WanaBana USA issued a voluntary nationwide recall of all lots of apple cinnamon fruit puree pouches that was expanded on November 9 to include private label brands Schnucks Apple Sauce with Cinnamon and Weis Cinnamon Apple Sauce (4). After the recall, NCSLPH continued to

[¶] FDA has developed draft guidance for action levels for lead in processed food intended for infants and young children: 10 ppb for fruits, vegetables (excluding single-ingredient root vegetables), mixtures, yogurts, custards and puddings, and single-ingredient meats; 20 ppb for root vegetables (single-ingredient); and 20 ppb for dry infant cereals. https://www.fda.gov/regulatory-information/search-fda-guidance-documents/draft-guidance-industry-action-levels-lead-food-intended-babies-and-young-children

** https://ehs.dph.ncdhhs.gov/docs/forms/cehu/SpiceandHomeRemedySurvey00000000000FINAL-English-fillable.pdf

test WanaBana products collected statewide from homes and stores, demonstrating consistently elevated lead concentrations (1.9–5.8 ppm). On November 13, CDC issued a nationwide Health Alert Network advisory that indicated multiple states had reported to FDA potential cases of high BLLs among children consuming recalled cinnamon-containing applesauce and recommended that clinicians report cases to their local health authorities (*5*).

Nationwide Investigation

After the recall, CDC launched a nationwide effort to systematically identify cases of BLLs greater than the CDC reference value of 3.5 μg/dL among children associated with consumption of the implicated products††. By January 2024, a total of 22 cases among children in North Carolina (all with BLLs ≥5 μg/dL, based on investigations going back to spring 2023) were identified and reported to CDC (Table). Of the 22 North Carolina cases, 10 (45%) were among children enrolled in Medicaid, and no typical sources of potential lead exposure were identified for any of the children with confirmed cases. On January 5, 2024, FDA reported that the source of lead in the involved products was cinnamon obtained from Ecuador, which also contained chromium in the form of lead chromate (*6*). A total of 519 cases nationwide were reported to CDC from state and local health departments as of March 22, 2024 (*6*).

North Carolina Recall Audit

The NCDHHS's Environmental Health Section notified local food banks, child care center operators, and school food service managers of the recall through a statewide listserv. County health department staff members were advised to look for the recalled product during routine inspections of schools, child care centers, and institutional facilities. NCDHHS worked with NCDACS and the North Carolina Association of Local Health Directors' leadership to ensure that recalled products were removed from retailer A stores. During 217 store visits conducted December 8–19 by county health department staff members, products were removed from five stores.

Discussion

Routine lead testing and environmental investigations in North Carolina resulted in the identification of a novel source of lead exposure that was ultimately linked to approximately 500 cases of childhood lead exposure nationwide, including 22 cases in North Carolina. In addition to following Centers for Medicare & Medicaid Services requirements for lead testing of Medicaid-enrolled children, CDC currently recommends focusing testing efforts on children having sociodemographic risk factors (e.g., being a racial or ethnic minority, living

†† https://www.cdc.gov/lead-prevention/news/outbreak-applesauce-pouches.html?CDC_AAref_Val=https://www.cdc.gov/nceh/lead/news/lead-poisoning- outbreak-linked-to-cinnamon-applesauce-pouches.html

TABLE. Selected characteristics of children with confirmed blood lead levels* ≥5 μg/dL and exposure to lead-contaminated WanaBana Apple Cinnamon Fruit Puree pouches (N = 22) — North Carolina, June 2023–January 2024

Characteristic	Investigated blood lead cases, according to CDC case definitions,† no. (%)			
	Confirmed	Probable	Suspected	Total
No. of cases (%)	11 (50)	6 (27)	5 (23)	**22 (100)**
Age, mos, mean (range)	19 (12–37)	21 (12–26)	19 (12–33)	**20 (12–37)**
Age, mos, median (IQR)	15 (13–23)	22 (17–26)	18 (13–21)	**17 (13–25)**
Male sex	7 (64)	5 (83)	2 (40)	**14 (64)**
Race				
Asian	2 (18)	1 (17)	0 (—)	**3 (14)**
Black or African American	2 (18)	1 (17)	2 (40)	**5 (23)**
White	5 (45)	3 (50)	3 (60)	**11 (50)**
Unknown	2 (18)	1 (17)	0 (—)	**3 (14)**
Hispanic or Latino ethnicity§	0 (—)	1 (17)	1 (20)	**2 (9)**
Enrolled in Medicaid	3 (33)	3 (50)	4 (80)	**10 (45)**
Initial BLL, μg/dL, mean (range)	15.2 (5.5–23.0)	9.1 (5.4–16.6)	7.1 (4.8–10.3)	**11.7 (4.8–23.0)**
Confirmatory BLL, μg/dL, mean (range)	12.9 (8.1–23.5)	9.2 (5.2–15.9)	8.0 (5.5–12.8)	**10.8 (5.2–23.5)**
Product lead level, ppm, mean (range)	3.0 (1.9–5.8)	NA	NA	**3.0 (1.9–5.8)**

Abbreviations: BLL = blood lead level; NA = not available.

* In North Carolina, a child has a confirmed high BLL when they have a blood lead concentration of ≥5 μg/dL determined by the lower of two consecutive blood tests within a 12-month period. The initial test might be from a capillary sample; however, the confirmatory test is preferably performed on a venous blood sample. Children with confirmed BLL 5–9 μg/dL are eligible for a home investigation to determine the source of exposure. When BLLs are confirmed ≥10 μg/dL, investigations are mandatory. Only those children eligible for an investigation (i.e., with BLLs ≥5 μg/dL) are included in the data reported.

† https://www.cdc.gov/lead-prevention/news/outbreak-applesauce-pouches.html?CDC_AAref_Val=https://www.cdc.gov/nceh/lead/news/lead-poisoning-outbreak-linked-to-cinnamon-applesauce-pouches.html

§ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

in a low-income household, or having environmental lead exposures) and those living in housing built before 1978.§§ However, fewer than one half of the North Carolina cases were among children enrolled in Medicaid, and no typical potential sources of lead exposure were identified as the likely cause for one half of the children, including those from households A, B, and C. This finding suggests that the recommendation for routine lead testing of all young children in North Carolina at ages 1 and 2 years might have led to detection of cases that would not otherwise have been identified and resulted in earlier identification and removal of a novel exposure source.

Although lead-contaminated paint, water, dust, and soil are the most recognized lead hazards, other products have been found to contain lead, including candies, spices, ceremonial powders, and alternative medicines (*7*–*9*). As older houses containing lead-based paint are renovated or demolished, environmental sources have become less frequent. Awareness of other sources, such as spices adulterated with lead chromate, is important (*10*).

This investigation highlights the potential benefits of broader routine blood lead testing for earlier detection of novel sources of lead exposure, such as foods and spices. Coordinated inter- agency collaboration and communication are essential for effectively detecting and responding to these events to prevent further harm.

§§ https://www.cdc.gov/lead-prevention/php/news-features/updates-blood-lead- reference-value.html

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[1]Division of Public Health, Children's Environmental Health, North Carolina Department of Health and Human Services; [2]Division of Public Health, North Carolina State Laboratory of Public Health, North Carolina Department of Health and Human Services; [3]Division of Public Health, Environmental Health Section, North Carolina Department of Health and Human Services.

Summary

What is already known about this topic?

Lead exposure is toxic even at low levels, especially in young children. In North Carolina, investigations are performed to identify potential exposure sources for children with blood lead levels (BLLs) ≥5 μg/dL.

What is added by this report?

During June–August 2023, routine testing identified four children in three unrelated North Carolina homes with BLLs ≥5 μg/dL. Investigations identified WanaBana Apple Cinnamon Fruit Puree pouches as the likely exposure source. A collaborative multilevel response led to detection of approximately 500 cases of childhood lead exposure potentially linked to consumption of apple cinnamon purees nationwide. Voluntary recall of the implicated products prevented additional exposures.

What are the implications for public health practice?

Routine BLL testing of young children and environmental investigations can help identify emerging sources of lead exposure.

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