

Chapter 4

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

Key Points	Page 1
Diagnostic (Confirmatory) Venous Testing	Page 2
Table 1. Diagnostic Testing Schedule	Page 2
Follow-Up based on Confirmatory Venous Test Results	Page 3
Table 2. Follow-Up Schedule for Diagnostic/ Confirmed Blood Lead Levels for Children Under the Age of Six	Page 4
Evaluating possible sources of lead exposure of a child with an elevated blood lead level	Page 5
Table 3. Clinical Evaluation	Page 6
Chelation	Page 7
Referrals/Resources	Page 7
Educating Families	Page 10

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

Key Points

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



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

Diagnostic (Confirmatory) Venous Testing

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

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

TABLE 1. DIAGNOSTIC TESTING SCHEDULE

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

Laboratory Testing

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

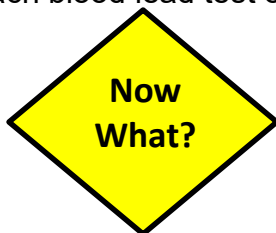
Required Information

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

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

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

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



Follow-up based on confirmatory venous test results

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

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

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

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

*Children's Developmental Service Agency

**Care Coordination for Children

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Resources:

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



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

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

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

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

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

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

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

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

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

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

TABLE 3. Clinical Evaluation for Complications of Lead Poisoning

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

Comments:

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

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

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

Chelation

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

Referrals/Resources

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

WIC Program Eligibility Criteria Includes:

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

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

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

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

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

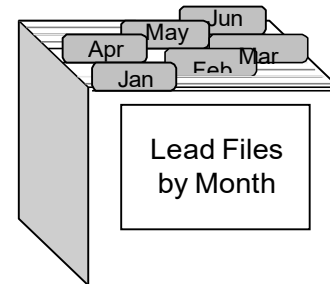
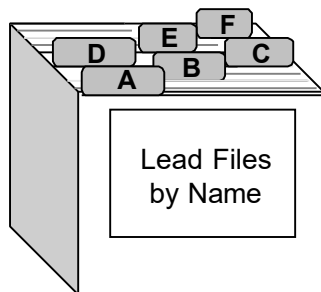
Lead Team. Comprehensive services are best provided by a case-management team that includes the health-care provider, care coordinator, community health nurse or health educator, environmental health specialist, social services liaison, and housing specialist. Coordination of care, environmental services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

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

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

Other Helpful Tips

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



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

Educating Families



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

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

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

Discuss with families:

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



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

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

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