Appendix J: Other Resources

North Carolina Childhood Blood Lead Surveillance Data

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

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

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

"**% Tested ≥ 5 µg/dL**" is the number of children tested with at least one result ≥ 5 µg/dL divided by the total number tested and multiplied by 100.

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

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

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

2017 NORTH CAROLINA CHILDHOOD BLOOD LEAD SURVEILLANCE DATA, BY COUNTY

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

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

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

2017 NORTH CAROLINA CHILDHOOD BLOOD LEAD SURVEILLANCE DATA, BY COUNTY

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

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

** 117 children tested were unable to be assigned to a county due to missing address.
State totals do not include those results missing county assignments.

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

Clinical and environmental follow-up is based on the *truncated* 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.

- Diagnostic tests should be venous; however, capillary tests are accepted if a venous cannot be obtained.
- Follow-up testing can be capillary.
- CDC protocol for capillary sampling of blood lead should be followed. (See Resources)
- If diagnostic test result falls into a lower category - follow response for the lower risk category.
- If diagnostic or follow-up test result falls into a **higher category** – conduct another 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.

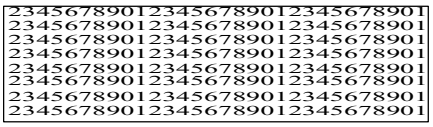
Blood Lead Level	Response
<5 µg/dL	• Report blood lead test result to parents and document notification • Educate family about lead sources and prevention of lead exposure **Retest at age 2, earlier if risk of exposure increases**
5-9 µg/dL (Perform diagnostic test **within 3 months**)	**Take same actions as above -AND- if diagnostic test result is 5-9 µg/dL:** • 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 **Follow-up testing: Every 3 months until 2 consecutive tests are <5 µg/dL (based on the *truncated* test result)**
10-44 µg/dL (Perform diagnostic test **within 1 month** at 10-19 µg/dL; **within 1 week** at 20-44 µg/dL)	**Take same actions as above -AND- if diagnostic test result is 10-44 µg/dL:** • Refer to local health department for required environmental investigation and remediation enforcement if hazards are identified • Refer child to CDSA* Early Intervention or CC4C** as appropriate • Refer to Social Services as needed for housing or additional assistance **Follow-up testing:** • **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 *truncated* test result)**
45-69 µg/dL (Perform diagnostic test **within 48 hours** at 45-59 µg/dL; **24 hours** at 60-69 µg/dL)	**Take same actions as above -AND- if diagnostic test result is 45-69 µg/dL:** • 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 **Follow-up testing: 45-69 µg/dL: every 2 weeks to 1 month until 2 consecutive tests are <5 µg/dL (based on the *truncated* test result)**
≥70 µg/dL (Perform emergency diagnostic test **immediately**)	**Take same actions as above -AND- if diagnostic test result is ≥70 µg/dL:** • Hospitalize child and begin medical treatment immediately **Follow-up testing: Same as 45-69 µg/dL category**

*Children's Developmental Service Agency **Care Coordination for Children *Updated 6/20/2018*

Resources:

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

NCPH North Carolina Public Health



CAPILLARY BLOOD SAMPLING PROTOCOL

The high potential for lead contamination of specimens during collection is well known,[1-3] and some have suggested special steps to minimize the likelihood of contamination. These include thorough scrubbing of the hand and finger with soap and then alcohol,[4-5] using dilute nitric acid [6-7] or using silicone or a similar barrier spray.[3, 8-10] In three recent CDC-funded studies, results showed that using a silicone barrier spray did not reduce contamination errors in capillary blood collection protocols.[11-13] However, results of these studies also showed that capillary blood collection by fingerstick had very low (<10%) contamination error rates.

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

A. Materials Needed

- Soap
- Alcohol swabs. If a surgical or other disinfectant soap is used, alcohol swabs can be eliminated.
- Sterile cotton balls or gauze pads
- Examination gloves
- Lancets. The type of lance used is largely a matter of personal preference as long as sterility is guaranteed.
- Microcollection containers. The laboratory should be consulted beforehand about the type of device it will accept. Some laboratories will provide "lead-free" tubes for blood lead screening purposes.
- Adhesive bandages.
- Trash bags suitable for medical waste and containers for sharps. Bags containing medical waste should be clearly identified as such.
- Storage or mailing containers if needed. If specimens require shipment, follow the U.S. P.S. or other appropriate regulations for the transport of body fluids.
- Laboratory coat and protective glasses.

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

B. Preparing for Blood Collection

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

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

C. Preparing the Finger for Puncture

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

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

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

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

Steps for Preparing the Child's Finger

1. Select examination gloves. If necessary, rinse them to remove powder.

2. Wash the child's hands thoroughly with soap and water, and then dry them with an appropriate towel.

3. Grasp the finger that has been selected for puncture between your thumb and index finger with the palm of the child's hand facing up.

4. If not done during washing (see preceding notes), massage the fleshy portion of the finger gently.

5. Clean the ball or pad of the finger to be punctured with the alcohol swab. Dry the fingertip using the sterile gauze or cotton ball.

Puncturing the Finger

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

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

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

Steps for Puncturing the Finger and Forming Drops of Blood

1. Grasp the finger and quickly puncture it with a sterile lancet in a position slightly lateral to the center of the fingertip.

2. Wipe off the first droplet of blood with a sterile gauze or cotton ball.

3. If blood flow is inadequate, gently message the proximal portion of the finger and then press firmly on the distal joint of the finger.

4. A well-beaded drop of blood should form at the puncture site.

5. Do not let the blood run down the finger or onto the fingernail.

E. Filling the Collection Container

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

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

Steps For Filling The Collection Container

1. Continuing to grasp the finger, touch the tip of the collection container to the beaded drop of blood.

2. Draw the blood into the container maintaining a continuous flow of blood.

3. When the container is full, cap or seal it as appropriate.

4. Agitate the specimen to mix the anticoagulant through the blood.

5. Check that the container is properly labeled, and place it in an appropriate storage area.

6. Stop the bleeding, and cover the finger with an adhesive bandage. Bleeding should stop quickly. If bleeding is slow to stop, apply pressure to the puncture site with a sterile gauze or a cotton ball. If bleeding continues after 3 to 5 minutes of applying pressure, consult a physician.

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