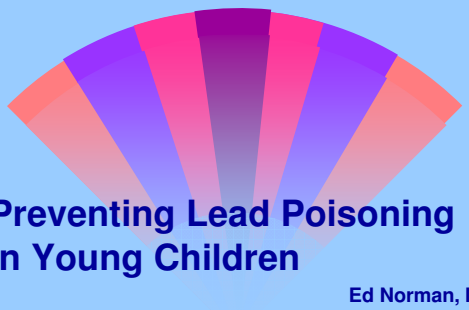

Preventing Lead Poisoning in Young Children

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What is Lead Poisoning?

- Disease caused by inhalation and/or ingestion of lead in the body
- No useful purpose for lead in the body
- Travels from the blood to soft tissue to bone
- Children not always symptomatic

Who is at Risk?

- Any young child is at risk regardless of where they live, the family's economic status or the family's race/ethnic background

Why?

- Children have more hand to mouth activity
- Children have greater sensitivity to the toxic effects of lead
- Children absorb lead more easily than adults

How?

- Lead is present in many sources
- Paint, dust, soil, vinyl mini-blinds, drinking water, food, air, occupations and hobbies
- Exposure may at home, at school, in the child care setting or on the playground

Signs and Symptoms

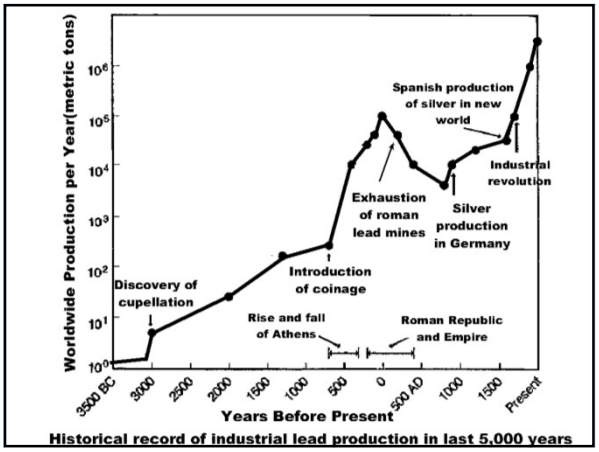
- Not always apparent; most children are asymptomatic
- If symptoms are present, may mimic other illnesses
- Stomach ache, cramps, irritability, fatigue, vomiting, constipation, headache, sleeping problems or poor appetite

Lower Levels of Lead Exposure

- May damage the central nervous system especially the brain
- Interfere with growth
- Affect hearing
- Lower IQ
- Learning difficulties
- Behavioral problems

Higher Levels of Lead Exposure

- Symptoms may become more apparent
- Clumsiness, weakness or loss of recently learned skills
- May result in coma, convulsions or death



Historical record of industrial lead production in last 5,000 years

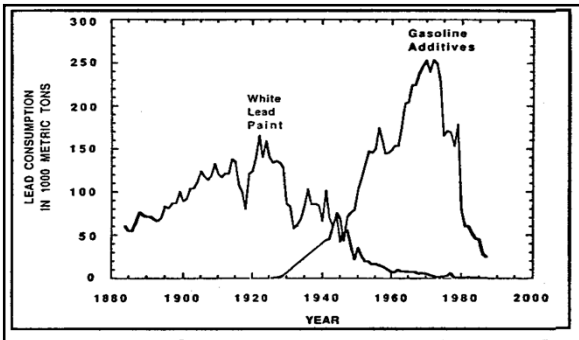
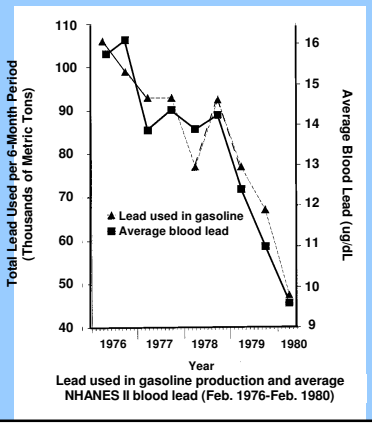


Figure 2. United States lead consumption, 1880-1987. Reprinted with permission from Clark S et al. Urban lead exposures of children in Cincinnati, Ohio. *Chemical Speciation and Bioavailability.* 1991;3:163-171. Copyright © 1991.



Lead used in gasoline production and average NHANES II blood lead (Feb. 1976-Feb. 1980)

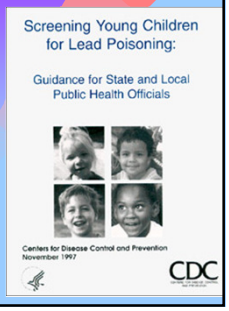
Childhood Lead Poisoning Costs:

- **Direct Medical & Public Health Costs**
- **Special Education**
- **Juvenile Justice**
- **Lost Future Earnings**

North Carolina Law:

- Laboratory reporting of all blood lead test results
- Investigation of confirmed lead poisoning and EBL cases
- Remediation of identified hazards for confirmed lead poisoning cases

Screening and Follow-up Recommendations from CDC



CDC Terminology

Reference Value:
5 µg/dL or greater

North Carolina State Law

Elevated blood lead level (EBL):
10 µg/dL or greater

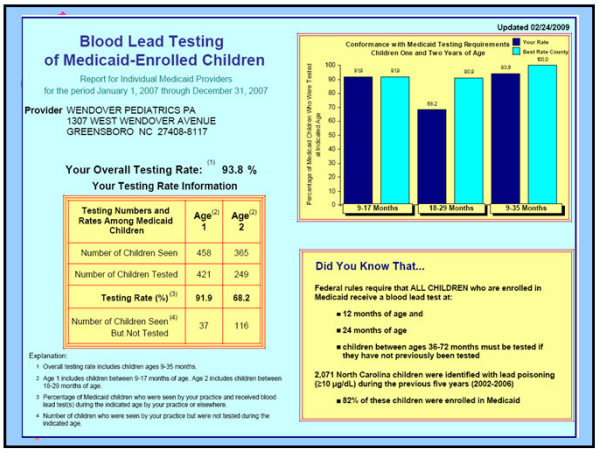
Confirmed lead poisoning:
20 µg /dL or greater

CDC Guidelines:

Universal assessment at 12 and 24 months or at first entry before age 6

NC Requirements:

Mandatory blood lead testing for population of children receiving Medicaid (Health Check), WIC, & Health Choice



Revised Recommendations

- Two consecutive blood lead tests within 6 months equal to or greater than 5 *u*g/dL are of concern.
- Continue screening until 2 consecutive tests are below 5 *u*g/dL.

Screening Test

- A laboratory test for lead that is performed on the blood of an asymptomatic child to determine whether or not the child has an elevated blood lead level.

Diagnostic Test

- A laboratory test for lead that is performed on the blood of a child that has a screening blood lead level of 5 *u*g/dL or greater
- The diagnostic test is the first venous blood test performed within 6 months of the screening test

Follow-up Test

- A laboratory test for lead that is performed on the blood that is used to monitor the status of a child with a previously elevated diagnostic test for lead

- **Direct blood measurement is the screening test of choice**
- **Finger-stick adequate for screening**
- **Venous preferred for diagnostic test**
- **State Laboratory will provide analysis of blood lead specimens for children less than six years of age at no charge**

State Lab Slip

- **Print (make it readable)**
- **Provide complete information**
- **Street address versus P.O. Box**
- **County where child lives**

Interpretation of Screening Test Results

< 5 ug/dL

- Report blood lead test result to parent & document
- Educate family
- Reassess or retest in 1 year

5-9 ug/dL

- Perform diagnostic testing within 3 mos.
- Report blood lead test result to parent
- Educate family
- Conduct nutritional assessment & refer to WIC
- Take environmental history
- Perform follow-up testing every 3 mos. until 2 consecutive tests are <5 *u*g/dL
- Test other children in the household

10-19 ug/dL

- Perform diagnostic testing within 1 month
- Report blood lead test result to parent
- Educate family
- Conduct nutr. assessment & refer to WIC
- Take environmental history
- Refer to health department for environmental investigation
- Perform follow-up testing every 1-3 mos. until 2 consecutive tests are <5 *u*g/dL
- Test other children in the household

20 ug/dL or greater

- Perform diagnostic testing within 1 week (or less)
- Report blood lead test result to parent
- Educate family
- Conduct nutritional assessment & refer to WIC
- Take environmental history
- Refer to health department for required environmental investigation
- Provide clinical management
- Refer to CDSA or CC4C as appropriate
- Refer to Social Services as needed
- Perform follow-up testing every 1 month until 2 consecutive tests are <5 *u*g/dL
- Test other children in the household

Clinical Management

For Children With Elevated Blood Lead Levels

History

- Chief complaint - why patient is there
- Subjective data - what patient tells you
- Objective data - what can be observed: labs, temperature, height/weight

Demographic Data

- Update address at each visit
  - *Mailing address
  - *Physical address
  - *Directions to home
- Obtain working telephone numbers
  - *Relative
  - *Neighbor or friend

Education

- Should be age & time appropriate
- Be thorough & concise
- Allow and encourage questions
- ALWAYS inform that further follow-up may be needed

Clinical Management

- Clinical evaluation
- Family lead education and referrals
- Chelation therapy if appropriate
- Follow-up testing at appropriate intervals

Clinical Evaluation

- Medical history
- Ask about:
  - Symptoms
  - Developmental history
  - Mouthing activities
  - Pica
  - Previous blood lead measurements, and
  - Family history of lead poisoning

Clinical Evaluation

- Environmental history
- Ask about age, condition of residence or where child spends most of his time
- Occupational and hobby histories of adults
- Ask about other potential sources of lead around the home

Clinical Evaluation

- Nutritional history
- Take a diet history
- Ask about water source for cooking/drinking
- Evaluate child's iron status
- Ask about use of FNS (food stamps) or WIC

Clinical Evaluation

- Physical examination
- Neurologic examination
- Psychosocial and language development

Family Lead Education

- Child's blood lead level and what it means
- Adverse health effects of lead exposure
- Sources of lead and how to reduce exposure
- Wet cleaning to reduce exposure
- Nutritional counseling
- Follow-up testing
- Results of environmental investigation
- Hazards of improper removal of lead-based paint

Chelation Therapy

- Children with confirmed blood lead levels 45 *u*g/dL or greater may be candidates for chelation therapy
- Conducted under a physician's care
- Must be in a lead-safe environment

Succimer-Chemet

- FDA approval since 1991
- Used to treat children with BLL >45 *u*g/dL
- Given orally, absorbed through GI tract
- Length of treatment: 19 days (2 week minimum)
- Recommended dosage: 10 mg/Kg q 8 hours X 5 days followed by 10 mg/Kg q 12 hours X 14 days
- Side effects minimal

Nutritional Implications

Nutrition Guidelines for Young Children

- Give 3 meals plus 1-2 snacks daily
- Give foods HIGH in iron, vitamin C, calcium and zinc
- When using tap water for drinking and cooking use only cold water. Run the water for a few minutes every morning before using it.

Nutritional Intervention

- Obtain a complete nutritional assessment
- Provide individualized nutritional counseling
- Determine eligibility for WIC (women, infant, children federal food program)

Nutritional Assessment

- ABCDE method of assessment with special emphasis on lead-related issues:
  - Anthropometric
  - Biochemical
  - Clinical
  - Dietary
  - Eco-Social

Anthropometric:

- Stature (length/height) and weight
- Assess growth using an age- and gender-appropriate growth chart

Biochemical:

- Blood lead level and test for iron deficiency anemia (hemoglobin or hematocrit)
- Many children with EBLs are iron deficient

Clinical

- Medical management of lead poisoning

Dietary:

- Meal pattern (3 meals and 1-2 snacks daily)
- Water supply and usage
- Adequacy of iron, vitamin C, calcium and zinc
- Pica & excessive mouthing
- Canned foods/food storage
- Traditional home remedies

Eco-social

- Review environmental assessment
- Assess home sanitation
- Meal preparation area
- Hand washing practices

Promote Breastfeeding

- Breastfed infants are exposed to lower concentrations of lead than formula-fed infants
- Maternal serum lead levels under 40 *u*g/dL are not associated with elevated lead levels in the breast milk

CDC Recommendations: Refugee Children

Lead Testing Recommendations for Refugee Children

- Test refugee children ages 6 months up to 16 years of age
- Need to have two blood lead tests regardless of the results of first blood lead test
- First test to be done with Refugee physical
- Second test to be done 3-6 months after permanent residential placement

Follow-up of Refugee Children

- Health Department Lead Nurse is the case manager for refugee children
- Collaboration between Health Department Lead Nurse and Health Check Coordinator will provide continuity of care

Additional recommendations for Refugee Children under 6 years

- Nutritional assessments as well as testing for hemoglobin or hematocrit level (with one or more of the following: mean corpuscular volume with the red cell distribution width, ferritin, transferrin saturation, or reticulocyte hemoglobin content.)
- For 6-59 months of age – provide daily pediatric multivitamins with iron

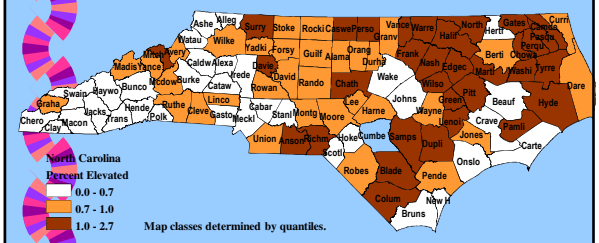
North Carolina Children Tested for Lead Poisoning, Years 1995-2008

Year	ages 6 mos to 6 yrs Number	ages 1 and 2 yrs Number	ages 1 and 2 yrs % tested	Confirmed ages 6 mos to 6 yrs 10-19 µg/dL	Confirmed ages 6 mos to 6 yrs ≥20 µg/dL
1995	87,895	44,308	21.9	718	178
1996	95,035	47,480	23.4	661	137
1997	95,172	49,424	24.0	547	114
1998	95,169	53,165	25.2	544	80
1999	105,552	66,401	30.4	565	80
2000	115,492	75,746	33.6	676	122
2001	120,166	82,178	35.1	467	73
2002	120,941	86,218	36.2	465	68
2003	121,717	88,052	37.4	470	38
2004	124,437	92,046	39.1	348	52
2005	128,052	96,546	40.6	301	53
2006	135,564	103,891	42.8	257	38
2007	143,932	112,537	44.9	233	39
2008	150,518	119,542	46.2	179	36

Characteristics and Estimated Prevalences of North Carolina Children Tested for Lead Poisoning During 2004-2008, Ages 6 months to 6 years

Variable		Testing Population N (Percent of Total)		Blood lead level (µg/dL) N (Percent) ≥10		≥ 20	
Age	6-12 months	37,601	(5.5)	210	(0.6)	35	(0.1)
	1 year	329,591	(48.3)	2,450	(0.7)	357	(0.1)
	2 years	194,971	(28.6)	1,805	(0.9)	233	(0.1)
	3 years	41,826	(6.1)	409	(1.0)	60	(0.1)
	4 years	45,058	(6.6)	298	(0.7)	46	(0.1)
	5 years	33,456	(4.9)	220	(0.7)	30	(0.1)
Race/Ethnicity	Black	168,490	(24.7)	1,819	(1.1)	224	(0.1)
	White	293,198	(43.0)	1,898	(0.6)	272	(0.1)
	Hispanic	119,838	(17.6)	959	(0.8)	156	(0.1)
	Native American	8,771	(1.3)	88	(1.0)	14	(0.2)
	Other	19,683	(2.9)	274	(1.4)	50	(0.3)
	Unknown	72,523	(10.6)	354	(0.5)	45	(0.1)
Sex	Male	333,845	(48.9)	2,881	(0.9)	436	(0.1)
	Female	338,510	(49.6)	2,483	(0.7)	322	(0.1)
	Unknown	10,148	(1.5)	28	(0.3)	3	(0.0)
Residence	Rural County	445,555	(65.3)	3,865	(0.9)	552	(0.1)
	Urban County	236,948	(34.7)	1,527	(0.6)	209	(0.1)
Income	Medicaid	356,629	(67.0)	3,587	(1.0)	487	(0.1)
	Non-Medicaid	175,356	(33.0)	1,005	(0.6)	144	(0.1)
Overall	**682,503 children tested**			**5,392**	**(0.8)**	**761**	**(0.1)**

Percent of 1- and 2-Year Old Children with Blood Lead Level ≥ 10 µg/dL 2004-2008



Improved follow-up care/testing:

Diagnostic Testing Among Children Tested for Lead Poisoning with Initial Test Result 10-14 µg/dL, Years 1995-2006

Year	Percent having test within: 1 mos	3 mos	6 mos	Number of Children
1995	3%	7%	15%	4,573
1996	3%	9%	21%	4,354
1997	4%	11%	25%	3,004
1998	9%	23%	43%	2,369
1999	25%	48%	64%	1,617
2000	29%	56%	73%	1,838
2001	28%	57%	72%	1,463
2002	32%	61%	75%	1,554
2003	30%	59%	72%	1,640
2004	35%	63%	75%	1,055
2005	37%	67%	79%	781
2006	36%	63%	74%	752

Blood Lead Reduction among Children with Confirmed Elevation ≥ 10 µg/dL* (overall) Years 1995 - 2007

Year	Number Cases	Mean Level* (% Reduced) at: Confirmation	6 mos follow/up	1 yr follow/up
1995	881	16.3	14.3 (12%)	12.2 (25%)
1996	789	15.5	13.4 (14%)	11.6 (25%)
1997	649	15.8	13.3 (16%)	11.7 (26%)
1998	618	15.2	11.7 (23%)	10.5 (30%)
1999	638	14.6	12.1 (17%)	10.3 (29%)
2000	790	15.3	11.7 (24%)	9.8 (36%)
2001	533	14.7	11.3 (23%)	9.8 (33%)
2002	527	15.0	11.0 (26%)	9.7 (35%)
2003	506	14.3	10.5 (26%)	8.3 (42%)
2004	398	15.0	10.7 (29%)	8.7 (42%)
2005	348	15.4	11.1 (28%)	9.3 (40%)
2006	294	15.5	11.3 (27%)	8.9 (43%)
2007	270	14.7	10.3 (30%)	9.2 (38%)

* micrograms per deciliter

The Lead Team

- The patient and patient's family
- Health care provider
- Public health nurse
- Environmental health specialist
- Nutritionist
- Laboratory technician
- Interpreter
- Social services liaison