Preventing Lead Poisoning in Young Children

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December 11, 2012
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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


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 ug/dL are of concern.
• Continue screening until 2 consecutive tests are below 5 ug/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 μg/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

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
- 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
< 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 ug/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 ug/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 ug/dL
- Test other children in the household

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

Clinical Management
For Children With Elevated Blood Lead Levels
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 µg/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 µg/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

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 Implications
**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 μg/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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Number tested</th>
<th>% tested</th>
<th>10-19 µg/dL</th>
<th>≥20 µg/dL</th>
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</thead>
<tbody>
<tr>
<td>1995</td>
<td>87,895</td>
<td>44,308</td>
<td>21.9</td>
<td>718</td>
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<td>49,424</td>
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<td>53,165</td>
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<td>105,552</td>
<td>66,401</td>
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<td>80</td>
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<td>2000</td>
<td>115,492</td>
<td>75,746</td>
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<td>86,218</td>
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<td>2003</td>
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<td>92,046</td>
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<td>52</td>
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<td>2005</td>
<td>128,052</td>
<td>96,546</td>
<td>40.6</td>
<td>301</td>
<td>53</td>
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<td>2006</td>
<td>135,564</td>
<td>103,891</td>
<td>42.8</td>
<td>257</td>
<td>38</td>
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<td>2007</td>
<td>143,932</td>
<td>112,937</td>
<td>49.4</td>
<td>233</td>
<td>39</td>
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<td>2008</td>
<td>150,518</td>
<td>119,542</td>
<td>46.2</td>
<td>179</td>
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Characteristics and Estimated Prevalences of North Carolina Children Tested for Lead Poisoning During 2004-2008, Ages 6 months to 6 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Testing Population</th>
<th>N (Percent of Total)</th>
<th>N (Percent)</th>
<th>Blood level (µg/dL)</th>
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<tbody>
<tr>
<td></td>
<td>6 mos</td>
<td>to 6 yrs</td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3</td>
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<td></td>
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<td>0.4</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
</tr>
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<td></td>
<td></td>
<td></td>
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<td>0.7</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.8</td>
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Improved follow-up care/testing:
Diagnostic Testing Among Children Tested for Lead Poisoning with Initial Test Result 10-14 µg/dL, Years 1995-2006

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

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cases</th>
<th>Mean Level* (% Reduced) at:</th>
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</thead>
<tbody>
<tr>
<td>1995</td>
<td>881</td>
<td>16.3</td>
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<tr>
<td>1996</td>
<td>789</td>
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<tr>
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<td>15.8</td>
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<td>1998</td>
<td>618</td>
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<td>2001</td>
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<td>2002</td>
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<td>15.0</td>
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<td>2003</td>
<td>506</td>
<td>14.3</td>
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<td>15.0</td>
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<tr>
<td>2005</td>
<td>348</td>
<td>15.4</td>
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<tr>
<td>2006</td>
<td>294</td>
<td>15.5</td>
</tr>
<tr>
<td>2007</td>
<td>270</td>
<td>14.7</td>
</tr>
</tbody>
</table>

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