Childhood Blood Lead Levels

Knox County Health Department

Patient Population, 1997-2007

Knox County Health Department
140 Dameron Avenue
Knoxville, Tennessee
Epidemiology Program
865-215-5093
www.knoxcounty.org/health
Acknowledgements

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Contributing Authors:
Albert Iannacone, MS, Environmental Epidemiologist
Donna Parang, MS, Epidemiologist
Kathleen Brown, PhD, Epidemiologist and Director, Epidemiology Program
Knox County Health Department
Knoxville, Tennessee

Questions concerning this report should be directed to:
Albert Iannacone, MS
Knox County Health Department
140 Dameron Avenue
Knoxville, Tennessee 37917
865-215-5242

This report may be viewed at the following web address:
www.knoxcounty.org/health/reports_data.php

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Introduction

Lead is a heavy metal used in many materials and products. It is a neurotoxic environmental contaminant and when absorbed in the body, it can be highly poisonous. Exposure to lead can come from lead-based paint, lead plumbing in older homes, or exposure to dust or soil that contains lead from old paint or near highways that are contaminated by leaded gasoline. Other sources include industrial and mining activities, toys and jewelry, folk medicine, some imported candies and pottery glazes.

Approximately 434,000 U.S. children age 1–5 years have blood lead levels (BLLs) greater than the National Centers for Disease Control and Prevention (CDC) recommended level of 10 micrograms of lead per deciliter of blood (10 µg/dL). [1] Lead is extremely harmful to children, especially developing fetuses and young children under age six, as it is easily absorbed and interferes with the development of the brain and other organs. There is no safe blood level of lead. Elevated BLLs (≥10 µg/dL) can result in learning disabilities, behavioral problems, mental retardation, and high levels (≥70 µg/dL) can cause seizures, coma or death. Recent research indicates lead has adverse health effects even at low levels (< 10 µg/dL), which are now considered levels of concern. Continued low levels of exposure in young children can cause reduced IQ and attention span, hyperactivity, impaired growth, reading and learning disabilities, hearing loss, insomnia and other health, intellectual, and behavioral problems. [2] In 1990, the U.S. Department of Health and Human Services (HHS) established a national goal to eliminate BLLs 25 µg/dL or greater by 2000; this goal was later revised to eliminate BLLs of 10 µg/dL or greater in children under age six by 2010. [3]

Age, poverty, race and area of the country all play a factor in a child’s risk for blood lead poisoning. Children under the age of six are at greater risk for exposure due to rapid brain development and the tendency to put their hands or other objects into their mouths, which may be contaminated with lead dust. Also, children living at or below poverty level who live in older housing are at greater risk because they have greater exposure to deteriorating lead paint on interior surfaces and tend to live in more industrialized urban areas that have airborne lead and residual lead in soil. [14] Certain populations, especially children in minority populations, are disproportionately affected [10]. For example, among non-Hispanic black children living in homes built before 1946, 22 percent had elevated BLLs. Because the risk for lead poisoning is spread unevenly throughout the population, efforts continue to identify children at risk and ensure that they receive preventive interventions. [7]

Childhood lead poisoning is a health problem where great success has been achieved but more work remains to be done. In 1984, there were 2 to 3 million young children with BLLs greater than 15 µg/dL and 250,000 children whose BLLs exceeded 25 µg/dL. By the early 1990s, these levels had dropped to fewer than 900,000 children with BLLs above 10µg/dL, the current standard for identifying children at risk. [5]
According to the CDC, “this dramatic reduction is the result of research to identify persons at risk, professional and public education campaigns to ‘spread the word,’ broad-based screening measures to find those at risk, and effective community efforts to clean up problem areas, namely, substandard housing units.” [4, 5] While these interventions have proven successful in lowering the number of children at risk for lead poisoning, continued program efforts to eliminate lead exposure in the environment are needed to eliminate elevated BLLs in children.

**Background**

This report is an up-date to the 1997 Knox County Health Department (KCHD) report “Childhood Lead Poisoning: Epidemiology and Recommendations for Knox County Providers” and the 2004 KCHD report “Childhood Lead Poisoning: Recent Trends and Observations”. [8, 9] In 1997, the CDC revised the blood lead monitoring guidelines for young children (less than 6 years old) to recommend targeted screening rather than universal screening. Targeted populations are children residing in areas where greater than 63% of the homes were built before 1950, and low-income children received care as part of government assistance programs. These recommendations are applicable to all health care providers in Knox County. Since the KCHD Pediatric Clinic has a patient population falling in the latter group, all of these patients in the targeted age range are screened for elevated BLL.

**Blood Lead Testing at KCHD**

Through the TennCare Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) Program, all children less than 72 months of age are tested for blood lead poisoning. According to the KCHD nursing protocol, all children are given a capillary blood lead test at 12 months and 24 months of age to determine blood lead levels. Also, if a child has not received a blood lead test by 72 months of age, they are given one. Refugee or foreign adopted children are capillary tested for lead as well as children that have been removed from an environment where methamphetamine was manufactured. Any child testing positive for lead (≥10 µg/dL) is then given a confirmatory venous test (Appendix II).

This analysis examines trends in blood lead levels among children tested at the KCHD from 1997 to 2007 and is only a snapshot of a population considered at higher risk for lead exposure due to demographics of the patients. It also affords an opportunity to identify potential improvements in current testing practices.
Methodology

The source of data for this report was from the KCHD Patient Billing, Tracking and Management Information System (PBTMIS) for the years 1997 to 2007. Only children 72 months of age and younger with a verifiable Knox County address and valid blood lead level result were included in the analysis and only one result for each child per year was analyzed.

Frequency results reflecting trends in the data sets were analyzed using Microsoft Excel. Figures were generated from the resulting tables found in Appendix I: Tables A.1 - A.4. Patient addresses were also used to generate maps of the residences of patients. The exact location of the address of the patient was randomly offset by a small amount to protect the privacy of the patient and comply with the Federal Health Insurance Portability and Accountability Act (HIPPA).

Results

Blood Lead Testing

During the 11-year time span, Jan. 1, 1997 to Dec. 31, 2007, there were 8,460 children tested for lead poisoning at Knox County Health Department with the highest level of testing occurring in 2006 and the lowest level was in 2000 (Figure 1).

Figure 1: Number of children tested for blood lead levels by year, Knox County Health Department, 1997-2007.
Figure 2 shows the percentages of children tested by age, gender and race. The largest percentage of children tested by age occurred in the 25-72 month age category (57.52%). The percentage of males (50.11%) tested for lead was slightly higher than females (47.60%). The percent of white children tested (58.90%) was almost twice that of black children (31.51%) and eight times more frequent than children in the other race category (7.30%). Detailed tables are contained in Appendix I.

**Figure 2: Percent of children > 72 months of age tested for blood lead levels by age group, gender and race, Knox County Health Department, 1997-2007.**

**Elevated Blood Levels**

Of the 8,460 children tested at KCHD during the 11-year period, 193 or 2.28% had blood lead levels ≥10 µg/dL. According to the National Health and Nutrition Examination Survey (NHANES) conducted for 1999-2000 (the most current available data), the prevalence of elevated BLLs in children for the U.S. population is 0.7%, a decrease from 2.2% in the 1991-1994 survey [10]. For the same time period (1999-2000), KCHD patients had a prevalence of 3.66%.

Of the children tested at KCHD, the 13-24 month age category (2.61%) and the 25-72 month age category (2.69%) each had similar percentages of elevated BLLs (Figure 3). Males had a slightly higher percent (2.30%) than females (2.26%) as did white children (2.43%) compared to black children (2.13%) (Figure 3). The “other” category represents all other racial groups combined. These children comprise about 1.5% of the Knox County population, based on the 2000 Census, and comprise 7.44% of children tested at KCHD and 1.75% of the elevated BLLs (Figure 3).
Figure 3: Percent of elevated BLLs of total children tested for blood lead levels by age, gender and race, Knox County Health Department, 1997-2007.

Elevated Blood Levels by Gender

Of those children having elevated BLLs, males were slightly higher than females, in each racial category (except “other”) and in total. With slightly more male than female children tested, this may be an artifact of a larger sample size. One unexpected finding is that elevated BLL was higher for “other” females than “other” males. This may be the result of the low number of individuals tested with “other” ethnicity, resulting in statistically unreliable data and these numbers should be interpreted with caution.

These results are consistent with CDC national data indicating that for the period 1991-1994 of children 1-5 years, 5.5% of males but only 3.3% of females had blood lead concentrations at or above the level of concern (10 µg/dL). This remained consistent in the 1999-2002 NHANES study 1.7% of males having elevated BLL and 1.4% of females [10]. This provides an added level of confidence that while the number of individuals in this analysis is not large, the overall trends in the data are as expected.
Temporal Trends in the Data

The following figures illustrate the trends over time in the prevalence of elevated BLLs, and in children tested at KCHD. During the 1997-2007 time span, the number of elevated cases generally dropped with a large exception in 2002 (Figure 4). These results are dependent on the number of children tested.

Figure 4: Cases by year of childhood elevated BLLs tested at the Knox County Health Department, 1997-2007.

Figure 5 examines the rates per 1,000 of elevated BLLs and reflects a more accurate picture of the progress towards the Healthy People 2010 goal of eliminating cases of elevated BLL.

Figure 5: Yearly rates of elevated BLL per 1,000 children tested at the Knox County Health Department, 1997-2007.
When examining data of only children without an elevated BLL test, the overall trend also continues towards lower BLLs, indicating progress in eliminating lead hazards for children in the Knox County community (Figure 6). This is significant information if the U.S. adopts a lower BLL standard, as has been done in the European Community and by the United Nations (U.N.) based on recent studies indicating levels as low as 5µg/dL may pose a health risk.

Figure 6: Yearly average BLL for children 72 months or younger tested at the Knox County Health Department, 1997-2007

Geographic Trends in the Data

An examination of the geographic location of children with elevated BLLs shows trends consistent with national data. Neighborhoods with the following characteristics were more likely to have children with elevated blood lead levels: older housing (pre-1960), minority residents, and residents living below the poverty threshold (Maps 1-3).

BLLs were coded to census information for the zip codes of the patient’s residence (Map 1). As consistent with national data, children with elevated BLLs were most likely to live in older neighborhoods where the likelihood of exposure to lead-based paint is greatest (although zip code 37915 seems to be an exception). This finding is consistent with CDC and literature findings and need not be reconfirmed in detail. Limitation: While some patients may not be living at the same residence where they were exposed to lead, there was no way to control or evaluate this factor using existing data.
Similarly, Map 2 illustrates that there is a correlation between elevated BLL and minority status, consistent with natural trends, but again with an apparent anomaly — this time in zip code 37917. This discrepancy and the apparent anomaly noted in the discussion of Map 1 both resolve when Map 3 is examined, comparing BLL to poverty levels.

Map 2: KCHD children with elevated blood lead levels by zip code and minority status in Knox County, 1997-2007
Economic Trends in the Data

Results were also evaluated against economic status, by mapping the number of cases from a zip code against the 2000 census median income of that zip code (Map 3). The data show a more precise correlation between income and lead exposure than for median age of housing in a census tract, but this is due at least in part to a self-selection effect in the data, that render any correlation between income and number of cases of elevated BLL suspect. One apparent outlier, the lack of cases in zip code 37916, is explained by the fact that the neighborhood involved is predominantly composed of students at the University of Tennessee, who would not be a part of the juvenile population tested for BLL by the KCHD.

Map 3: KCHD children with elevated blood lead levels by zip code and poverty level in Knox County, 1997-2007

Expected Versus Reported Number of Cases

The CDC data reported in the Introduction are from the National Health and Nutrition Examination Surveys [NHANES] [10]. These data indicate that on average 2.2% of all children are expected to have elevated BLLs (Table 1). However, across 19 states, the CDC found county-specific proportions of children with BLLs at or over 10 µg/dL ranged from 0.5% to 27.3% for a similar population. [11]

The 1997 KCHD report estimated prevalence in the Knox County population of 2.0% in all children and 3.9% of children tested by the KCHD, consistent with CDC estimates for that time. The estimated value was presented as an upper limit, as it was based on children tested by the KCHD and should be biased high by an undefined amount, due to the low-income target population served. Since Knox County historically did not have as large a growth in housing stock as other, larger cities during the time when lead-based paint was widely used and did not have a prominent history of industries involving lead, this finding is reasonable.
Table 1: NHANES blood lead level measurements for children aged 1-5 years by year, United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Prevalence(^\d) of elevated BLLs (95% CI)</th>
<th>Estimated number of children with elevated BLLs (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976 – 1980</td>
<td>88.2% (83.8 - 92.6)</td>
<td>13,500,000 (12,800,000 - 14,100,000)</td>
</tr>
<tr>
<td>1988 – 1991</td>
<td>8.6%(^5) (4.8-12.4%)</td>
<td>1,700,000 (960,000-2,477,000)</td>
</tr>
<tr>
<td>1991 – 1994</td>
<td>4.4% (2.9-6.6%)</td>
<td>890,000 (590,000-1,330,000)</td>
</tr>
<tr>
<td>1999 – 2000</td>
<td>2.2% (1.0-4.3%)</td>
<td>434,000(^\d) (189,000-846,000)</td>
</tr>
</tbody>
</table>

\(^1\) The number of children with elevated BLLs over the whole population at a given point in time. \(^5\) This estimate differs slightly from values published previously due to updates in coding and weighting of the survey data.

In the 2004 KCHD report, the rate of elevated BLLs for children tested by KCHD was 3.6%. This is only slightly lower than the 1997 result from the KCHD, and does not meet the Healthy People 2010 target for 0% elevated BLL. However, when the data were examined year by year for rate of patients with an elevated BLL, a trend of declining incidence over the period of the report was evident, mirroring national trends.

This trend has been found to continue through 2007 in the current analysis. In this surveillance the rate of elevated BLLs for children tested at KCHD was 2.28%. The factors quoted from the 2004 KCHD report contribute to this result, and indicate continued progress towards meeting the Healthy People 2010 targets for childhood BLL in Knox County.
Summary

The incidence of elevated BLL in at-risk children tested by the KCHD appears to be on the decline reported in the 2004 KCHD report, mirroring national trends. This indicates that current lead abatement and public education programs are addressing the problem, and that economic expansion and central city renovation in recent years likely caused additional lead removal in older properties beyond government remediation programs.

Differences in risk between genders for elevated blood lead are small in the KCHD data. These differences are consistent with prevalence seen in national data, where males are at slightly higher risk of elevated BLL than females.

Minority and low-income children living on older properties are over-represented in the KCHD patient population versus the overall population of Knox County. As a result, the majority of these groups in both children tested and children with elevated BLL in the KCHD data is not surprising and not representative of conditions county-wide.

Recommendations

- The current levels of public education and blood lead testing by the Knox County Health Department should be maintained, as this likely contributed to the decreasing incidence of children with elevated BLL seen in the reporting period. However, there may need to be a change in emphasis in the messages to account for growth of specific minorities in the population (e.g. Hispanics) and newly identified risk sources (see next bullet).

- Programs supporting lead paint abatement activities appear to be having the desired result, and should be continued. Lead paint is not the only route of potential exposure to lead (other exposure routes include soil/dust, lead trinkets/toys, and lead drinking water pipes), and specific projects to investigate the prevalence of these environmental risk factors may be appropriate in cases where such exposures are suspected.

- The KCHD should continue to monitor the incidence of elevated BLL, especially in the event of economic downturns, which might slow or reverse the rate of progress towards the national HHS Healthy People 2010 goal of elimination of elevated BLL. Incidences of recalls of trinkets/toys containing lead should continue to be monitored by environmental epidemiologists.

- Investigation to identify additional data sources, more representative of the wider Knox County population, should be undertaken to identify the incidence of elevated BLL across the county as a whole.
References


Appendices

Tables

KCHD Blood Lead Screening Protocol
Table A.1: Number and percent of children tested for blood lead poisoning by age, gender and race, Knox County Health Department, 1997-2007

<table>
<thead>
<tr>
<th></th>
<th>0-12 Months</th>
<th>13-24 Months</th>
<th>25-72 Months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1997</td>
<td>1104</td>
<td>742</td>
<td>2493</td>
<td>4339</td>
</tr>
<tr>
<td>Female</td>
<td>1034</td>
<td>713</td>
<td>2373</td>
<td>4120</td>
</tr>
<tr>
<td>Total</td>
<td>2139*</td>
<td>1455</td>
<td>4866</td>
<td>8460*</td>
</tr>
</tbody>
</table>

*Total includes 1 unknown gender

Table A.2: Number and percent of children < 6 years tested for blood lead poisoning by year, gender and race, Knox County Health Department, 1997 – 2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
<td>Black</td>
<td>Other</td>
</tr>
<tr>
<td>1997</td>
<td>196</td>
<td>63</td>
<td>9</td>
</tr>
<tr>
<td>1998</td>
<td>267</td>
<td>121</td>
<td>8</td>
</tr>
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<td>1999</td>
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<tr>
<td>2006</td>
<td>362</td>
<td>196</td>
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</tr>
<tr>
<td>2007</td>
<td>335</td>
<td>184</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>2622</td>
<td>1387</td>
<td>330</td>
</tr>
</tbody>
</table>

| Percent | 30.99% | 16.39% | 3.90% | 51.29% | 29.37% | 15.80% | 3.52% | 48.70% | 100.00% |

*Includes 1 unknown gender
Tables

Table A.3: Number and percent* of children < 6 Years with elevated BLLs by age, gender and race, Knox County Health Department, 1997 – 2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>0-12 Months</th>
<th>13-24 Months</th>
<th>25-72 Months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>1.18%</td>
<td>18</td>
<td>2.43%</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>1.06%</td>
<td>20</td>
<td>2.81%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>1.12%</td>
<td>38</td>
<td>2.61%</td>
</tr>
</tbody>
</table>

*Percent of Total Tested

Table A.4: Number and percent* of children with elevated BLL by year, gender and race, Knox County Health Department, 1997-2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
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<td>1</td>
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<tr>
<td>2007</td>
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<tr>
<td>Total</td>
<td>66</td>
<td>31</td>
</tr>
<tr>
<td>Percent</td>
<td>2.52%</td>
<td>2.24%</td>
</tr>
</tbody>
</table>

*Percent of Total Tested
KCHD Blood Lead Screening Protocol

General Information

Possible lead sources include the following:
- Housing built prior to 1978 with old chipping paint, lead water pipes or lead soldered pipes
- Work or hobbies involving paint, chemicals, battery, auto body repair fillers, leaded glass, lead sinkers, lead glazed pottery and toys with lead contents
- Pewter or leaded crystal containers for storing, cooking or eating food/drink, tobacco and ashes
- Plastic or vinyl mini-blinds
- Close proximity to frequently used highway (leaded gasoline) or near industrial site
- Recently renovated home or frequently visited house/building built before 1978
- Folk medicine and cosmetics such as Mexican, Asian and Middle Eastern and in East Tennessee, remedies made with moonshine
- Sibling, housemate, frequent visitor, playmate of children with known toxicity
- Children under age 6 years living in older homes and living in poverty have the highest risk for lead poisoning

Effects of Lead Toxicity Include:
- Very low levels are associated with decreased intelligence, behavior problems, decreased growth and hearing difficulties
- Low levels can affect the central nervous system and kidneys
- Very severe lead exposure in children can cause coma, convulsions and even death

Subjective

1. Risk is determined from the response to the question on the Lead Risk
2. Assessment Questionnaire (Table 1) on well visits for children 6 months to 72 months
3. If parent/guardian answer “yes” or “I don’t know” to any question, child is considered to be at high risk and should be screened with a finger stick BLL
4. Children removed from houses in which methamphetamines is being manufactured should have blood lead testing.
5. All children from outside the United States (adopted or refugee) should have blood lead testing.
6. If the child has no primary care provider, refer to KCHD Social Services or Department of Human Services for TennCare

Objective N/A

Assessment N/A
Lead Screening Plan

1. Obtain a finger stick blood lead level (BLL) at well child visit on all children 12 months and 24 months of age.
2. Obtain a finger stick BLL at well child visit on children 36 to 72 months of age that do not have a previously documented lead blood test.
3. Confirm all elevated blood lead levels (10 ug/dL or greater) with venous blood sampling.
4. Obtain a finger stick BLL for siblings (6 to 72 months of age) of children with a confirmed elevated BLL and consult with parents regarding the need to test other frequent playmates, pregnant household members, siblings and others.
5. Consult parent(s) or caretaker regarding results and need for follow-up with Primary Care Provider (PCP).
6. Comprehensive follow-up services must be based on child’s confirmed BLL and managed according to schedule for follow-up BLL Testing.
8. Follow-up
   a. Stress need for appropriate follow-up, testing treatment and intervention.
   b. Repeat BLL according to guidelines.
   c. Stress need for removal of lead source.
   d. If developmentally delayed, refer to appropriate programs.
   e. Assure appropriate environmental investigation by Childhood Lead Poisoning Prevention Program (CLPPP).
   f. For certified inspection, assessment and abatement firms in the area, call the Lead Line at 1-888-771-5323; if child lives in Section 8 housing and has had an elevated blood lead level, the Tennessee Housing Development Agency will be notified for environment investigation assessment and correction of the problem. If child is covered under TennCare, parent/guardian should contact PCP for referral for environmental investigation; if referral is denied, assist the parent/guardian with the appeal process.
9. Health Teaching
   a. Educate regarding sources of lead (lead based paint, soil and dust, drinking water, certain occupation/hobbies, air, food, burning lead painted wood, some “folk” remedies, cosmetics, tobacco and ashes, auto body repair filler, toys and other).
   b. Be alert to parental occupations or hobbies, stress hand washing, showering, proper handling of soiled clothes and shoes.
   c. Educate regarding the effects and potential problems of lead poisoning.
      Provide Nutritional Counseling:
      • Need for three meals and some snacks per day with adequate iron, calcium and vitamin C (empty stomach increases lead absorption).
      e. In older housing, use only fully flushed water (let water run one to two minutes from cold-water tap) for cooking, drinking and making formula.
2: Blood Lead Risk Assessment Questionnaire

<table>
<thead>
<tr>
<th>Mandatory Questions</th>
<th>Optional Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your child live in or regularly visit a house built before 1978? (This could include a day care center, home of a baby sitter, or a relative.)</td>
<td>Does your child frequently come in contact with an adult who work's with lead? (Examples: construction, welding, pottery, etc.)</td>
</tr>
<tr>
<td>Does your child live in or regularly visit a house built before 1978 with recent, ongoing, or planned renovations or remodeling (within the past 6 months)?</td>
<td>Does your home contain any plastic or vinyl mini blinds made before 1996?Have you ever been told that your child has low iron? Have you seen your child eating paint chips, crayons, soil, or dirt?</td>
</tr>
<tr>
<td>Does your child have a sibling or a playmate that has, or did have, lead poisoning?</td>
<td>Does your child live near or visit with someone who lives near a lead smelter, battery recycling plant or other industry that could release lead?</td>
</tr>
<tr>
<td></td>
<td>Do you give your child any home or folk remedies that may contain lead? (Such as moonshine, Azarcon, Greta, Paylooah)</td>
</tr>
<tr>
<td></td>
<td>Does your child live within 80 feet (or one block) of a heavily traveled street?</td>
</tr>
<tr>
<td></td>
<td>Does your home's plumbing have lead pipes or copper pipes with lead solder joints? Does your family use pottery ware or leaded crystal for cooking, eating, or drinking?</td>
</tr>
</tbody>
</table>

3: Recommended Schedule for a Confirmatory Venous Sample

<table>
<thead>
<tr>
<th>Screening Test Result (µg/dL)</th>
<th>Perform a confirmation venous test within:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>3 months</td>
</tr>
<tr>
<td>20-44</td>
<td>1 week-1 month</td>
</tr>
<tr>
<td>45-59</td>
<td>48 hours</td>
</tr>
<tr>
<td>60-69</td>
<td>24 hours</td>
</tr>
<tr>
<td>&gt;70</td>
<td>immediately, as an emergency lab test</td>
</tr>
</tbody>
</table>

*The higher the BLL on the screening test, the greater the need for confirmatory testing*
4: Schedule for Follow-up Blood Testing

Medical management includes follow-up blood lead testing. The following table (Table 3) presents the suggested frequency of follow-up test and should be used as guidance.* Case managers and PCPs should consider individual characteristics and caregiver capabilities and adjust the frequency of follow-up test accordingly.

<table>
<thead>
<tr>
<th>Confirmed Venous Blood Lead Level (ug/dl)</th>
<th>Early Follow-Up (first 2-4 test after identification)</th>
<th>Late Follow-Up (after BLL begins to decline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-14</td>
<td>3 months**</td>
<td>6-9 months</td>
</tr>
<tr>
<td>15-19</td>
<td>1-3 months**</td>
<td>3-6 months</td>
</tr>
<tr>
<td>20-24</td>
<td>1-3 months**</td>
<td>1-3 months</td>
</tr>
<tr>
<td>25-44</td>
<td>2 weeks-1 month</td>
<td>1 month</td>
</tr>
<tr>
<td>&gt;45</td>
<td>As soon as possible</td>
<td>Chelation, subsequent follow-up</td>
</tr>
</tbody>
</table>

*Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow-ups.

**Some case managers or PCPs may choose to repeat blood lead tests on all new patients within a month to ensure that their BLL is not rising more quickly than anticipated.

5: Medical Management Summary of Lead Poisoning in Accordance with Confirmed Blood Lead Levels

<table>
<thead>
<tr>
<th>Confirmed Venous Blood Lead Level (ug/dl)</th>
<th>Hospitalize and chelate</th>
<th>Consider chelation, possibly oral</th>
<th>Environmental investigation **</th>
<th>Hemoglobin</th>
<th>Measurement of iron states</th>
<th>Follow-up blood lead monitoring</th>
<th>Dietary education</th>
<th>Environmental and education</th>
<th>Complete neurological exam</th>
<th>Neurodevelopmental monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-14</td>
<td></td>
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<td>15-19</td>
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</table>

**Contact Childhood Lead Poisoning Prevention Prevention when an environmental investigation is indicated at (615) 741-0355.