There is no safe level of lead in the blood.
All blood lead test results, by law, are required to be reported to ODH by the analyzing laboratory.

### Lead Testing Requirements

1. **Is the child on Medicaid?**
   - If yes, **TEST AT AGES 1 AND 2 — IT’S OHIO LAW!** (OAC Rule 5101:3-14-03).

2. **Does the child live in a High Risk ZIP Code?** (see list on back or visit [http://www.odh.ohio.gov](http://www.odh.ohio.gov))
   - If yes, **TEST— IT’S OHIO LAW!**

3. **Ask the parent these five key questions to assess the child’s risk.**

   - **Does your child:**
     - Live in or regularly visit a house built before 1950? This includes a day care center, preschool, or home of a baby sitter or relative.
     - Live in or visit a house that has peeling, chipping, dusting or chalking paint?
     - Live in or visit a house built before 1978 with recent, ongoing, or planned renovation/remodeling?
     - Have a sibling or playmate who has or did have lead poisoning?
     - Frequently come in contact with an adult who has a hobby or works with lead? Examples are construction, welding, pottery, painting, and casting ammunition.

   - If the family answers “yes” or “do not know” to any of the above questions, **TEST— It’s Ohio law.**
   - If the family answers “no,” provide prevention guidance and follow up at the next visit.

### Blood Lead Levels (BLL) and Medical Management Recommendations

<table>
<thead>
<tr>
<th>BLL (µg/dL)</th>
<th>Medical Management Recommendations</th>
</tr>
</thead>
</table>
| <5          | • Provide anticipatory guidance during well child care visits at 6, 9 and 12 months: discuss sources, effects of lead and hazards associated with renovating pre 1978 homes.  
              • Test blood lead level (BLL) again in 12 months. |
| 5–9         | In addition to medical management actions listed above: explain child’s BLL and how to reduce exposure and absorption.  
              • Explain that there is no safe level of lead in the blood.  
              • Discuss wet cleaning to remove lead dust on surfaces; eliminating access to deteriorating lead paint surfaces; and ensuring regular meals that are low in fat and rich in calcium and iron.  
              • Refer to the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) or for other nutritional counseling.  
              • Parent may hire licensed personnel to conduct a lead risk assessment to determine source of exposure. |
| 10–19       | In addition to medical management actions listed above:  
              • Confirm capillary results by venous or second capillary blood sample within one month.  
              • When results are confirmed, test BLL again in two months. If BLL persists in this level (i.e., two confirmed tests ≥10µg/dL at least two months apart), proceed according to actions for BLL 20-44.  
              • Refer to Help Me Grow program if appropriate.  
              • Test BLL every one-two months until the BLL remains <10µg/dL for at least six months and lead hazards have been removed or made lead safe and no new exposure exists.  
              State or local health department will conduct a public health lead investigation and provide case management. |
| 20–44       | In addition to medical management actions listed above:  
              • Take medical, environmental and nutritional hx; test for anemia and iron deficiency; assess neurologic, psychosocial and language development; screen all siblings under 6; and evaluate risk of other family members (e.g., pregnant women).  
              • Refer to the Bureau for Children with Medical Handicaps (BCMH) program, if appropriate.  
              • In addition to medical management actions listed above:  
              • Confirm fingerstick (capillary) results by venous blood sample immediately. A venous specimen will ensure therapy is based on current and reliable information.  
              • Chelation therapy is indicated if venous testing confirms level.  
              • Immediately remove child from exposure source. |
| ≥45         | In addition to medical management actions listed above:  
              • Confirm fingerstick (capillary) results by venous blood sample immediately. A venous specimen will ensure therapy is based on current and reliable information. |
High Risk ZIP Codes

Requiring Blood Lead Testing

for children under the age of six years, as Ohio law designates

Ohio Department of Health • Bureau of Child and Family Health Services
Ohio Healthy Homes and Lead Poisoning Prevention Program (OHHLPPP)

The Lead Risk Model used to determine the

High Risk ZIP codes was developed by The
Ohio State University, Center for Biostatistics.

2000 Census data and 2001 blood lead data
were used to locate census tracts, which
were then overlaid with ZIP code boundaries.

• ZIP code with any part of a hot census tract
is considered to be at high risk.

The variables used in the Lead Risk Model included:

• All at least 12% of children tested in that
census tract have BLL 10µg/dL or higher

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Lead Exposure in Children: Prevention, Detection, and Management

ABSTRACT. Fatal lead encephalopathy has disappeared and blood lead concentrations have decreased in US children, but approximately 25% still live in housing with deteriorated lead-based paint and are at risk of lead exposure with resulting cognitive impairment and other sequelae. Evidence continues to accrue that commonly encountered blood lead concentrations, even those less than 10 μg/dL, may impair cognition, and there is no threshold yet identified for this effect. Most US children are at sufficient risk that they should have their blood lead concentration measured at least once. There is now evidence-based guidance available for managing children with increased lead exposure. Housing stabilization and repair can interrupt exposure in most cases. The focus in childhood lead-poisoning policy, however, should shift from case identification and management to primary prevention, with a goal of safe housing for all children. Pediatrics 2005;116:1036–1046; child, lead, environmental exposure, chelation therapy, succimer, cognition, clinical trials, housing, prevention, behavior.

ABBREVIATIONS. CDC, Centers for Disease Control and Prevention; AAP, American Academy of Pediatrics; EPA, Environmental Protection Agency; CNS, central nervous system; EP, erythrocyte protoporphyrin; EDTA, ethylenediaminetetraacetic acid; TLC, Treatment of Lead-Exposed Children; HUD, Department of Housing and Urban Development.

BACKGROUND

In 1991, when 1 in 11 US children had a blood lead concentration greater than 10 μg/dL, both the Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics (AAP) recommended that all US children have their blood lead concentration measured at around 1 and 2 years of age, when concentrations increase and then peak. By 1997, the median blood lead concentration in the United States had decreased, and screening in some areas with newer housing turned up few cases of elevated blood lead concentration. The CDC and AAP then began to recommend screening only those children with a greater chance of having an elevated blood lead concentration—those in older housing, those who had a sibling or playmate with an elevated blood lead concentration, or those who had lived in or visited a structure that might contain deteriorated, damaged, or recently remodeled lead-painted surfaces. Screening of all children eligible for Medicaid, among whom were found 80% of those with increased blood lead concentration, continued to be recommended and had been required by Health Care Financing Administration (now the Centers for Medicare and Medicaid Services) regulation since 1989.

This new policy statement replaces the 1998 statement and includes discussion of new data, including:

- Reliable estimates of the percentage of the US homes containing lead hazards;
- Results from a large clinical trial showing that chelation in children with moderately elevated blood lead concentrations does not improve cognitive or neuropsychologic test scores;
- Documentation of unacceptably low screening rates among Medicaid-eligible children;
- Further confirmation of the link between lead exposure in early childhood and delinquent behavior during adolescence; and
- New data showing inverse associations between blood lead concentrations less than 10 μg/dL and IQ.

The best approach to lead poisoning is to prevent exposure in the first place, but it will be years before that goal is realized. In the meantime, case finding, case management, and prevention of additional exposure will still be required. This document considers relevant aspects of the epidemiology, clinical toxicology, prevention, and treatment of lead exposure in young children and provides recommendations for pediatricians as well as public health authorities.

DECLINE OF LEAD POISONING IN THE UNITED STATES

Lead is an element and occurs naturally, but blood lead concentrations are quite low in the absence of industrial activities. In the United States, there were historically 2 major sources of industrially derived lead for children: airborne lead, mostly from the combustion of gasoline containing tetraethyl lead; and leaded chips and dust, mostly from deteriorating lead paint. Both contribute to soil lead. A steep decrease in exposure to airborne lead in the United States has occurred since 1980. Federal legislation in the 1970s removed lead from gasoline and decreased smokestack emissions from smelters and other sources, causing blood lead concentrations in children to decrease. From 1976 to 1980, before the regulations had their full effect, US children 1 to 5 years...
of age had a median blood lead concentration of 15 μg/dL. In 1988–1991, the median was 3.6 μg/dL; in 1999, the median was 1.9 μg/dL. Although concentrations have decreased in all children, black children and poor children continue to have higher blood lead concentrations. Airborne lead should no longer be a source of community exposure in the United States, but individual counties sometimes still exceed airborne lead regulations, and continued vigilance is warranted. Individual children may still be exposed to airborne lead in fumes or respirable dust resulting from sanding or heating old paint, burning or melting automobile batteries, or melting lead for use in a hobby or craft.

SOURCES OF LEAD EXPOSURE

Lead Paint, Dust, and Soil

The source of most lead poisoning in children now is dust and chips from deteriorating lead paint on interior surfaces. Children who developed lead encephalopathy with blood lead concentrations more than 100 μg/dL often had chips of lead paint visible on abdominal plain films. Children who live in homes with deteriorating lead paint, however, can achieve blood lead concentrations of 20 μg/dL or greater without frank pica. The use of leaded paint on interior surfaces ceased in the United States by the mid-1970s. However, in 1998, of the 16.4 million US homes with ≥1 child younger than 6 years, 25% still had significant amounts of lead-contaminated deteriorated paint, dust, or adjacent bare soil (“lead hazard”). Dust and soil are also a final resting place for airborne lead from gasoline and dust from paint. Lead in dust and soil can recontaminate cleaned houses and contribute to elevating blood lead concentrations in children who play on bare, contaminated soil.

Transplacental Exposure and Lead in Human Milk

Lead crosses the placenta, and the blood lead concentration of the infant is similar to that of the mother. The source of lead in the infant’s blood seems to be a mixture of approximately two thirds dietary and one third skeletal lead, as shown by studies that exploited the differences in lead isotopes stored in the bones of women migrating from Europe to Australia. Although lead appears in human milk, the concentration is closer to plasma lead and much lower than blood lead, so little is transferred. Because infant formula and other foods for infants also contain lead, women with commonly encountered blood lead concentrations who breastfeed their infants expose them to slightly less lead than if they do not breastfeed. In Mexico, giving women supplemental calcium during lactation resulted in a small (less than 2 μg/dL) decrease in the mother’s blood lead concentration, presumably by decreasing skeletal resorption. Theoretically, this could diminish transfer of lead through breast milk even further. In the United States, however, where calcium intake may be higher, calcium supplementation does not prevent bone loss during lactation and, thus, might not affect lead transfer at all.

Other Sources

Lead plumbing (in Latin, “plumbus” = lead) has contaminated drinking water for centuries, and lead in water can contribute to elevated blood lead concentrations in children. In 2003–2004, some tap water in Washington, DC, was found to exceed Environmental Protection Agency (EPA) regulations. This was thought to be caused by a change in water disinfection procedures, which increased the water’s ability to leach lead from connector pipes between the water mains and interior plumbing in old houses. The extent of this problem in Washington and other cities is not yet known. Affected families are drinking filtered or bottled water until the pipes can be replaced. (Most bottled water is not fluoridated; its consumption may lead to marginal fluoride intakes in children.) Much more about lead in drinking water is available on the EPA Web site (www.epa.gov/safewater/lead/index.html).

Table 1 includes questions about less common sources of lead exposure, which include hobbies, contaminated work clothes, ceramics, cosmetics, imported canned foods, etc. Such questions may be useful if a child has an elevated blood lead concentration but no exposure to leaded dust or soil. They have not been validated for the purpose of deciding whether to screen.

The lead concentration of blood for transfusion is not routinely measured. After exchange transfusion in the extremely low birth weight infant, 90% of the infant’s blood is donor blood. Bearer et al recommended that only units with lead concentrations of less than 0.09 μmol/L be used in these patients, on the basis of their adaptation of the World Health Organization tolerable weekly intake from ingestion to intravenous injection. Approximately one third of the units of blood that they measured were above this concentration. The effect of lead in transfused blood used in older children has not been considered.

TOXICITY OF LEAD

Subclinical Effects

At the levels of lead exposure now seen in the United States, subclinical effects on the central nervous system (CNS) are the most common effects. The best-studied effect is cognitive impairment, measured by IQ tests. The strength of this association and its time course have been observed to be similar in multiple studies in several countries. In most countries, including the United States, blood lead concentrations peak at approximately 2 years of age and then decrease without intervention. Blood lead concentration is associated with lower IQ scores as IQ becomes testable reliably, which is at approximately 5 years of age. The strength of the association is similar from study to study: as blood lead concentrations increase by 10 μg/dL, the IQ at 5 years of age and later decreases by 2 to 3 points. Canfield et al recently extended the relationship between blood lead concentration and IQ to blood lead concentrations less than 10 μg/dL. They observed a decrease in IQ of more than 7 points over the first 10 μg/dL of
lifetime average blood lead concentration. Bellinger and Needleman subsequently reported a similarly steep slope in a reanalysis of data from their study of children with blood lead concentrations similar to those in the Canfield et al study. To confirm the adverse effects of lead on IQ at these concentrations, however, more children whose blood lead concentration has never been more than 10 μg/dL should be studied. A reanalysis of the primary data from several of the prospective studies is underway to help resolve this issue. At the moment, however, these data have not yet been incorporated into policy, and the CDC and AAP both currently use 10 μg/dL (Table 2) as the blood lead concentration of concern.

Other aspects of brain or nerve function, especially behavior, also may be affected. Teachers reported that students with elevated tooth lead concentrations were more inattentive, hyperactive, disorganized, and less able to follow directions. Additional follow-up of some of those children showed higher rates of failure to graduate from high school, reading disabilities, and greater absenteeism in the final year of high school. Elevated bone lead concentrations are associated with increased attentional dysfunction, aggression, and delinquency. In children followed from infancy with blood lead measurements, self-reported delinquent behavior at 15 to 17 years of age increased with both prenatal and postnatal lead exposure, and bone lead, thought to represent cumulative dose, is higher in adjudicated delinquents. These data imply that the effects of lead exposure are long lasting and perhaps permanent. Subclinical effects on both hearing and balance may occur at commonly encountered blood lead concentrations. Although there are reasonable animal models of low-dose lead exposure and cognition and behavior, the mechanisms by which lead affects CNS function are not known. Lead alters very basic nervous system functions, such as calcium-modulated signaling, at very low concentrations in vitro, but it is not yet clear whether this process or some other one yet to be examined is the crucial one. Lead interferes detectably with heme synthesis beginning at blood lead concentrations of approximately 25 μg/dL. Both aminolevulinate dehydratase, an early step enzyme, and ferrochelatase, which completes the heme ring, are inhibited. Ferrochelatase inhibition is the basis of an erstwhile screening test for lead poisoning that measures erythrocyte protoporphyrin (EP), the immediate heme precursor. Because it is insensitive to the lower concentrations of

<table>
<thead>
<tr>
<th>TABLE 1. Suggested Clinical Evaluation for Lead Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical history</td>
</tr>
<tr>
<td>Ask about</td>
</tr>
<tr>
<td>Symptoms</td>
</tr>
<tr>
<td>Developmental history</td>
</tr>
<tr>
<td>Mouthing activities</td>
</tr>
<tr>
<td>Pica</td>
</tr>
<tr>
<td>Previous blood lead concentration measurements</td>
</tr>
<tr>
<td>Family history of lead poisoning</td>
</tr>
<tr>
<td>Environmental history</td>
</tr>
<tr>
<td>Paint and soil exposure</td>
</tr>
<tr>
<td>What is the age and general condition of the residence or other structure in which the child spends time?</td>
</tr>
<tr>
<td>Is there evidence of chewed or peeling paint on woodwork, furniture, or toys?</td>
</tr>
<tr>
<td>How long has the family lived at that residence?</td>
</tr>
<tr>
<td>Have there been recent renovations or repairs to the house?</td>
</tr>
<tr>
<td>Are the windows new?</td>
</tr>
<tr>
<td>Are there other sites at which the child spends significant amounts of time?</td>
</tr>
<tr>
<td>What is the condition/make-up of indoor play areas?</td>
</tr>
<tr>
<td>Do outdoor play areas contain bare soil that may be contaminated?</td>
</tr>
<tr>
<td>How does the family attempt to control dust and dirt?</td>
</tr>
<tr>
<td>Relevant behavioral characteristics of the child</td>
</tr>
<tr>
<td>To what degree does the child exhibit hand-to-mouth activity?</td>
</tr>
<tr>
<td>Does the child exhibit pica?</td>
</tr>
<tr>
<td>Are the child’s hands washed before meals and snacks?</td>
</tr>
<tr>
<td>Exposures to and behaviors of household members</td>
</tr>
<tr>
<td>What are the occupations of adult household members?</td>
</tr>
<tr>
<td>What are the hobbies of household members? (Fishing, working with ceramics or stained glass, and hunting are examples of hobbies that involve risk for lead exposure.)</td>
</tr>
<tr>
<td>Are painted materials or unusual materials burned in household fireplaces?</td>
</tr>
<tr>
<td>Miscellaneous</td>
</tr>
<tr>
<td>Does the home contain vinyl miniblinds made overseas and purchased before 1997?</td>
</tr>
<tr>
<td>Does the child receive or have access to imported food, cosmetics, or folk remedies?</td>
</tr>
<tr>
<td>Is food prepared or stored in imported pottery or metal vessels?</td>
</tr>
<tr>
<td>Does the family use imported foods in soldered cans?</td>
</tr>
<tr>
<td>Nutritional history</td>
</tr>
<tr>
<td>Take a dietary history</td>
</tr>
<tr>
<td>Evaluate the child’s iron status by using the appropriate laboratory tests</td>
</tr>
<tr>
<td>Ask about history of food stamps or participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)</td>
</tr>
<tr>
<td>Physical examination</td>
</tr>
<tr>
<td>Pay particular attention to the neurologic examination and the child’s psychosocial and language development</td>
</tr>
</tbody>
</table>

1038 LEAD EXPOSURE IN CHILDREN
blood lead that are of concern now, the test is obsolete for that use; however, EP measurement is still used clinically in managing children with higher blood lead concentrations.

### Clinical Effects

Children with blood lead concentrations greater than 60 μg/dL may complain of headaches, abdominal pain, loss of appetite, and constipation and display clumsiness, agitation, and/or decreased activity and somnolence. These are premonitory symptoms of CNS involvement and may rapidly proceed to vomiting, stupor, and convulsions. Symptomatic lead toxicity should be treated as an emergency. Although lead can cause clinically important colic, peripheral neuropathy, and chronic renal disease in adults with occupational exposures, these symptoms are rare in children.

### Table 2: Summary of Recommendations for Children With Confirmed (Venous) Elevated Blood Lead Concentrations

<table>
<thead>
<tr>
<th>Blood Lead Concentration</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>10–14 μg/dL</td>
<td>Lead education</td>
</tr>
<tr>
<td></td>
<td>Dietary</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
</tr>
<tr>
<td></td>
<td>Follow-up blood lead monitoring</td>
</tr>
<tr>
<td>15–19 μg/dL</td>
<td>Lead education</td>
</tr>
<tr>
<td></td>
<td>Dietary</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
</tr>
<tr>
<td></td>
<td>Follow-up blood lead monitoring</td>
</tr>
<tr>
<td></td>
<td>Proceed according to actions for 20–44 μg/dL if</td>
</tr>
<tr>
<td></td>
<td>A follow-up blood lead concentration is in this range at least 3 months after initial venous test; or</td>
</tr>
<tr>
<td></td>
<td>Blood lead concentration increases</td>
</tr>
<tr>
<td>20–44 μg/dL</td>
<td>Lead education</td>
</tr>
<tr>
<td></td>
<td>Dietary</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
</tr>
<tr>
<td></td>
<td>Follow-up blood lead monitoring</td>
</tr>
<tr>
<td></td>
<td>Complete history and physical examination</td>
</tr>
<tr>
<td></td>
<td>Lab work</td>
</tr>
<tr>
<td></td>
<td>Hemoglobin or hematocrit</td>
</tr>
<tr>
<td></td>
<td>Iron status</td>
</tr>
<tr>
<td></td>
<td>Environmental investigation</td>
</tr>
<tr>
<td></td>
<td>Lead hazard reduction</td>
</tr>
<tr>
<td></td>
<td>Neurodevelopmental monitoring</td>
</tr>
<tr>
<td></td>
<td>Abdominal radiography (if particulate lead ingestion is suspected) with bowel decontamination if indicated</td>
</tr>
<tr>
<td>45–69 μg/dL</td>
<td>Lead education</td>
</tr>
<tr>
<td></td>
<td>Dietary</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
</tr>
<tr>
<td></td>
<td>Follow-up blood lead monitoring</td>
</tr>
<tr>
<td></td>
<td>Complete history and physical examination</td>
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<tr>
<td></td>
<td>Lab work</td>
</tr>
<tr>
<td></td>
<td>Hemoglobin or hematocrit</td>
</tr>
<tr>
<td></td>
<td>Iron status</td>
</tr>
<tr>
<td></td>
<td>Free EP or ZPP</td>
</tr>
<tr>
<td></td>
<td>Environmental investigation</td>
</tr>
<tr>
<td></td>
<td>Lead hazard reduction</td>
</tr>
<tr>
<td></td>
<td>Neurodevelopmental monitoring</td>
</tr>
<tr>
<td></td>
<td>Abdominal radiography with bowel decontamination if indicated</td>
</tr>
<tr>
<td></td>
<td>Chelation therapy</td>
</tr>
<tr>
<td>≥70 μg/dL</td>
<td>Hospitalize and commence chelation therapy</td>
</tr>
<tr>
<td></td>
<td>Proceed according to actions for 45–69 μg/dL</td>
</tr>
</tbody>
</table>

### Not Recommended at Any Blood Lead Concentration

- Searching for gingival lead lines
- Evaluation of renal function (except during chelation with EDTA)
- Testing of hair, teeth, or fingernails for lead
- Radiographic imaging of long bones
- X-ray fluorescence of long bones

ZPP indicates zinc protoporphyrin.
whose blood lead concentrations decreased the most. A large (780-children) randomized trial of the use of succimer in children with blood lead concentrations of 20 to 44 µg/dL, the Treatment of Lead-Exposed Children (TLC)3 Trial, showed no benefit on cognitive or neuropsychologic testing despite an abrupt but transient decrease in the treated children’s blood lead concentrations. The children were randomly assigned at approximately 2 years of age and followed with cognitive, neuropsychologic, and behavioral tests until they were approximately 5 years of age. The large size of the trial permits confident exclusion of a drug-related improvement of 2 IQ points or more. Additional follow-up at 7 years of age with more sophisticated testing still showed no advantage for the succimer-treated children.37

Because blood lead concentrations decreased as the children in the TLC Trial got older regardless of whether they had chelation, Liu et al38 used the TLC data to attempt to replicate the reported relationship between decreasing blood lead concentrations and improved cognitive test scores. Test scores were unrelated to decreasing blood lead concentrations at 6 months’ follow-up, but results from following the children for 36 months, when they were approximately 5 years of age, showed improved test scores with greater decreases in blood lead concentration but only in the placebo group. Additional research on whether some effective intervention can be isolated to account for this phenomenon is needed. There remains no evidence that chelation will reverse cognitive impairment, and the predominance of data is consistent with a noncausal association between decreasing blood lead concentrations and improved cognitive test scores.

COSTS OF CHILDHOOD LEAD POISONING AND BENEFITS OF PREVENTION

Cost-Benefit Analyses

The removal of lead from gasoline cost money, and it will cost more money to remove lead from housing. If childhood lead exposure, however, affects cognitive function and its consequences, such as graduating from high school, then it is plausible that it will affect social function, employment, and earnings. Several groups have estimated the long-term dollar costs of childhood lead exposure, assuming that the effect of lead on IQ is linear and permanent; they also assume a specific economic value of increased IQs. Grosse et al39 estimated the economic benefit of the 25-year secular downward trend in childhood lead exposure in the cohort of children 2 years of age in 2000. The estimated increase in earnings for the 3.8 million children would be between $110 billion and $319 billion over their lifetimes, compared with what they would have earned if they had been exposed to 1975 lead levels. Landrigan et al40 estimated the lifetime costs for each year’s cohort of children currently exposed to lead to be $43 billion. On the cost side, Needleman41 estimated a $10 billion cost for deleading the estimated 2 million lead-contaminated houses that existed in 1990. In 2002, a more reliable estimate is that there are 4 million such lead-contaminated houses,2 and when adjusting for inflation (with the Consumer Price Index inflation calculator [www.bls.gov/cpi]), Needleman’s estimate becomes approximately $28 billion in 2002. Combining these estimates leads to the conclusion that removing lead paint is cost-effective if it prevents even two thirds of lead exposure for any single year’s cohort of 2-year-olds. Similarly, a presidential task force estimated that the net nationwide benefit of interim control of lead hazards in the nation’s pre-1960 housing would be $1 billion to $9 billion over 10 years. The benefit of abating the hazards permanently would be $21 billion to $36 billion. Such quantitation allows planning and setting priorities to be done more transparently and allows comparisons to estimates of the cost for lead-abatement programs and other preventive activities. Although these are exemplary numbers in simplified analyses, all parts of which could be challenged, they illustrate the rationale for viewing lead exposure as a problem that should be solved, even on economic grounds.

Federal Strategy to Prevent Lead Poisoning

The President’s Task Force on Environmental Health Risks and Safety Risks to Children was formed in 1997 by executive order. It consists of government officials from the EPA, the Department of Health and Human Services, the Consumer Product Safety Commission, the Department of Housing and Urban Development (HUD), and others. One of its first projects was to formulate a plan to eliminate childhood lead poisoning,42 a goal that was incorporated into the Healthy People 2010 goals for the nation(www.healthypeople.gov/Document/HTML/Volume1/08Environmental.htm#_Toc490564710). For the first time, the strategy concentrated on primary prevention and was directed at housing. It did not require that a lead-poisoned child first be identified before a house was considered eligible for participation (the principle of primary prevention). The core of the strategy is a grant-based program administered by the HUD that would accelerate the pace at which in-place management of lead hazards would occur in US homes. The strategy projected that more than 20 million houses could be remediated in the decade from 2000–2010, making lead-safe housing available to a large majority of US children. The strategy also included continued screening, especially among Medicaid-eligible children, enforcement of existing statutes and regulations, and research, especially on the effectiveness of in-place management of lead hazards. The HUD plans periodic evaluations and progress reports, which can be tracked on its Web site (www.hud.gov/offices/lead).

DIAGNOSTIC MEASURES

The diagnosis of lead poisoning or increased lead absorption depends on the measurement of blood lead concentration. This is best performed by using a venous sample, but a carefully collected finger-stick sample can be used. Most blood lead measurements are now performed because the child meets some general eligibility criteria (screening) and not be-
cause they are at especially high risk of exposure or have symptoms suggestive of lead poisoning (diagnosis).

Screening

Between 1991 and 1997, both the AAP and CDC recommended universal screening, that is, that all children have their blood lead concentration measured, preferably when they are 1 and 2 years of age. Because the prevalence of elevated blood lead concentrations has decreased so much, a shift toward targeted screening has begun, and the criteria for and implementation of targeted screening continues to develop. As of early 2005, the situation is as follows. All Medicaid-eligible children must be screened. Medicaid will reimburse 2 screenings, one at 1 year of age and one at 2 years of age. Most children with elevated blood lead concentrations are Medicaid eligible, and most Medicaid-eligible children have not been screened. The Advisory Committee on Childhood Lead Poisoning Prevention has proposed criteria by which a state could acquire an exemption from this requirement, and the proposal is under consideration in the Secretary of Health and Human Services’ office. Until such exemptions are granted, both the CDC and AAP support universal screening of Medicaid-eligible children. The thinking behind the availability of exemptions is not primarily to decrease the number of screenings performed but rather to increase it among groups in which increased lead absorption will be found. Children whose families participate in any assistance program but who, for whatever reason, are not eligible for Medicaid should also be screened. For children not eligible for Medicaid, several states and some municipalities have developed targeted screening recommendations or policies using suggestions made by the CDC, their own data, or some combination of the 2. All practitioners should determine if such recommendations are in place where they practice. Appropriate contacts at state and city health departments with CDC-funded programs are listed on the CDC Web site (www.cdc.gov/nceh/lead/grants/contacts/CLPPP%20Map.htm).

The approach to screening children who are not eligible for Medicaid and who live in areas in which health authorities have not made locale-specific recommendations is less clear. Although targeted screening may be desirable, well-validated tools with which to achieve it are not yet in place. In the absence of policy, current recommendations support screening all children who are not enrolled in Medicaid and who live in areas in which local authorities have not issued specific guidance.

There are now many case reports of children who are recent immigrants, refugees, or international adoptees who have elevated (sometimes very elevated) blood lead concentrations. Such children should be screened on arrival in the United States.

Diagnostic Testing

Some experienced clinicians measure the blood lead concentration in children with growth retardation, speech or language dysfunction, anemia, and attentional or behavioral disorders, especially if the parents have a specific interest in lead or in health effects from environmental chemicals. However, a persistent elevation of blood lead concentration into school age is unusual, even if peak blood lead concentration at 2 years of age was high and the child’s housing has not been abated. This is probably because hand-to-mouth activity decreases and the child’s body mass increases. Thus, a low blood lead concentration in a school-aged child does not rule out earlier lead poisoning. If the question of current lead poisoning arises, however, the only reliable way to make a diagnosis is with a blood lead measurement. Hair lead concentration gives no useful information and should not be performed. Radiograph fluorescence measurement of lead in bone is available in a few research centers and has been used in children as young as 11 years with acceptable validity for research purposes, but it has no clinical utility as yet.

MANAGEMENT OF CHILDREN WITH ELEVATED BLOOD LEAD CONCENTRATIONS

In 2002, the national Advisory Committee on Childhood Lead Poisoning Prevention published a monograph, “Managing Elevated Blood Lead Levels Among Young Children.” The goal of the monograph was to provide an evidence-based, standard approach to management usable throughout the United States. Anyone involved with the management of children with elevated blood lead concentrations needs access to it. This section is consistent with the monograph.

The management of children with elevated blood lead concentrations is determined primarily by how high the concentration is (Table 2). Children with concentrations less than 10 µg/dL are not currently considered to have excess lead exposure. Children with concentrations 10–19 µg/dL or greater should have their concentrations rechecked; if many children in a community have concentrations greater than 10 µg/dL, the situation requires investigation for some controllable source of lead exposure. Children who ever have a concentration greater than 20 µg/dL or persistently (for more than 3 months) have a concentration greater than 15 µg/dL require environmental and medical evaluation.

Residential Lead Exposure

Most children with elevated blood lead concentrations live in or regularly visit a home with deteriorating lead paint on interior surfaces. Some children eat paint chips, but pica is not necessary to achieve blood lead concentrations of 20 µg/dL or greater. Children can ingest lead-laden dust through normal mouthing behaviors by simply placing their hand or an object in their mouth. This also happens when children handle food during eating. There is increasing evidence that professional cleaning, paint stabilization, and removal and replacement of building components can interrupt exposure. Cooperation with the health department in investigating and decreasing the source is necessary. Although some authorities insist that moving children to unloaded
housing or removal of all lead paint from their current housing is the only acceptable solution,\textsuperscript{51} alternative housing is rarely available and extensive on-site removal of lead paint can raise the concentration in house dust and resident children.\textsuperscript{52} Lead in soil is higher around houses with exterior lead paint and in places where there has been a smokestack or other point source or heavy traffic. Soil concentrations are related to blood lead concentrations but not as closely as are interior dust lead concentrations.\textsuperscript{13} Soil can be tested for lead content, and the EPA has guidelines for testing on its Web site (www.epa.gov/lead/leadtest.pdf). Lead should no longer be a problem in municipal water supplies, but wells, old pipes from the municipal supply to the house (as has been the case in Washington, DC), or soldered joints may add lead to water (see www.epa.gov/safewater/lead/index.html).

### Other Sources

Some children will have persistently elevated blood lead concentrations without access to lead paint, bare soil, or lead in their drinking water. Their exposure may come from any of the sources listed in Table 3. Blood lead concentrations should decrease as the child passes approximately 2 years of age, and a stable or increasing blood lead concentration beyond that age is likely to be caused by ongoing exposure.

The recommended approach to environmental investigation of a child with an elevated blood lead concentration consists of (1) an environmental history, such as the one shown in Table 1, (2) an inspection of the child’s primary residence and any building in which they spend time regularly, (3) measurement of lead in deteriorated paint, dust, bare soil, or water as appropriate, (4) control of any immediate hazard, and (5) remediation of the house, which may require temporary relocation of the child. If new or lead-safe housing is an option for the family, it offers a simple and permanent solution. These situations can be frightening for the families. Involving the family and providing them with information as it is obtained is the right thing to do and may help lessen anxiety.

Although intense regimens of professional cleaning decrease children’s blood lead concentrations, providing families with instructions and cleaning materials does not. Washing children’s hands has intuitive appeal, but no data support its role in decreasing exposure. Suggested prevention strategies are listed in Table 3.

### Medical Management

If the blood lead concentration is greater than 45 \( \mu g/dL \) and the exposure has been controlled, treatment with succimer should begin. A pediatrician experienced in managing children with lead poisoning should be consulted; these pediatricians can be found through state health department lead programs, through pediatric environmental health specialty units (www.aoe.org/pehsu.htm), at hospitals that participated in the largest clinical trial of succimer,\textsuperscript{3} or by calling the local poison control center or the AAP Committee on Environmental Health. The most common adverse effects of succimer listed on the label are abdominal distress, transient rash, elevated hepatocellular enzyme concentrations, and neutropenia. The drug is unpleasant to administer because of a strong “rotten-egg” odor, and 40% of the families on active drug compared with 26% on placebo found the drug difficult to administer.\textsuperscript{53} The succimer label provides dosages calculated both by body surface area and by weight, but the equivalent dose by both methods would occur in a child approximately 5 years of age. For the younger children

### Table 3. Sources of Lead Exposure and Prevention Strategies\textsuperscript{59}

<table>
<thead>
<tr>
<th>Source</th>
<th>Prevention Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
</tr>
<tr>
<td>Paint</td>
<td>Identify and abate</td>
</tr>
<tr>
<td>Dust</td>
<td>Wet mop (assuming abatement)</td>
</tr>
<tr>
<td>Soil</td>
<td>Restrict play in area, plant ground cover, wash hands frequently</td>
</tr>
<tr>
<td>Drinking water</td>
<td>Flush cold-water pipes by running the water until it becomes as cold as it will get (a few seconds to 2 minutes or more; use cold water for cooking and drinking)</td>
</tr>
<tr>
<td>Folk remedies</td>
<td>Avoid use</td>
</tr>
<tr>
<td>Cosmetics containing additives such as kohl or surma</td>
<td>Avoid use</td>
</tr>
<tr>
<td>Old ceramic or pewter cookware, old urns/kettles</td>
<td>Avoid use</td>
</tr>
<tr>
<td>Some imported cosmetics, toys, crayons</td>
<td>Avoid use</td>
</tr>
<tr>
<td>Contaminated mineral supplements</td>
<td>Avoid use</td>
</tr>
<tr>
<td>Parental occupations</td>
<td>Remove work clothing at work; wash work clothes separately</td>
</tr>
<tr>
<td>Hobbies</td>
<td>Proper use, storage, and ventilation</td>
</tr>
<tr>
<td>Home renovation</td>
<td>Proper containment, ventilation</td>
</tr>
<tr>
<td>Buying or renting a new home</td>
<td>Inquire about lead hazards</td>
</tr>
<tr>
<td>Lead dust in carpet</td>
<td>Cover or discard</td>
</tr>
<tr>
<td>Host</td>
<td></td>
</tr>
<tr>
<td>Hand-to-mouth activity (or pica)</td>
<td>Frequent hand washing; minimize food on floor</td>
</tr>
<tr>
<td>Inadequate nutrition</td>
<td>Adequate intake of calcium, iron, vitamin C</td>
</tr>
<tr>
<td>Developmental disabilities</td>
<td>Enrichment programs</td>
</tr>
</tbody>
</table>
typically given the drug, body surface area calculations give higher doses, which are those that are recommended.54

Although chelation therapy for children with blood lead concentrations of 20 to 44 µg/dL can be expected to lower blood lead concentrations, it does not reverse or diminish cognitive impairment or other behavioral or neuropsychologic effects of lead.3 There are no data supporting the use of succimer in children whose blood lead concentrations are less than 45 µg/dL if the goal is to improve cognitive test scores.

Children with symptoms of lead poisoning, with blood lead concentrations higher than 70 µg/dL, or who are allergic or react to succimer will need parenteral therapy with EDTA and hospitalization. Guidelines for these circumstances are beyond the scope of this statement, but the same consultation as described above is recommended. There are academic centers that use D-penicillamine, another oral chelator used in Wilson disease, for lead poisoning. Its safety and efficacy, however, have not been established,55 and the AAP Committee on Drugs considers it to be a third-line drug for lead poisoning.56

Dietary Intervention

The Advisory Committee on Childhood Lead Poisoning Prevention reviewed the evidence for dietary intervention in lead-exposed children.16 They concluded that there are no trial data supporting dietary interventions aimed specifically at preventing lead absorption or modulating the effects of lead. However, there are laboratory and clinical data suggesting that adequate intake of iron, calcium, and vitamin C are especially important for these children. Adequate iron and calcium stores may decrease lead absorption, and vitamin C may increase renal excretion. Although there is epidemiologic evidence that diets higher in fat and total calories are associated with higher blood lead concentrations at 1 year of age,57 the absence of trial data showing benefits and the caloric requirements of children at this age preclude recommending low-fat diets for them.

Psychological Assessment

The Advisory Committee on Childhood Lead Poisoning Prevention reviewed the evidence for psychological assessment and intervention in lead-exposed children.16 Despite data from several large epidemiologic studies suggesting that moderate exposure to lead produces specific deficits in attention or executive functions, visual-spatial skills, fine-motor coordination, balance, and social-behavioral modulation,58 there is no specific “signature” syndrome yet identified. In addition, although 2-year-olds tend to have the highest blood lead concentrations, they will usually not have detectable cognitive damage, which can be expected to become more apparent at 4 years of age and later. It seems reasonable to manage children whose blood lead concentration is 20 µg/dL or greater at its peak as having a higher risk of developmental delay and behavior abnormalities.16 Because the effects emerge later, after the child’s blood lead concentration will have decreased, the child’s record must be kept open even after the blood lead concentration has decreased.

Although there is not specific literature supporting the use of enrichment programs in lead-poisoned children, programs aimed at children with delay from another cause should be effective in lead-poisoned children.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Provide anticipatory guidance to parents of all infants and toddlers about preventing lead poisoning in their children. In particular, parents of children 6 months to 3 years of age should be made aware of normal mouthing behavior and should ascertain whether their homes, work, or hobbies present a lead hazard to their toddler. Inform parents that lead can be invisibly present in dust and can be ingested by children when they put hands and toys in their mouths.

2. Inquire about lead hazards in housing and child care settings, as is done for fire and safety hazards or allergens. If suspicion arises about the existence of a lead hazard, the child’s home should be inspected. Generally, health departments are capable of inspecting housing for lead hazards. Expert training is needed for safe repair of lead hazards, and pediatricians should discourage families from undertaking repairs on their own. Children should be kept away from remediation activities, and the house should be tested for lead content before the child returns.

3. Know state Medicaid regulations and measure blood lead concentration in Medicaid-eligible children. If Medicaid-eligible children are a significant part of a pediatrician’s practice or if a pediatrician has an interest in lead poisoning, he or she should consider participating in any deliberations at the state and local levels concerning an exemption from the universal screening requirement.

4. Find out if there is relevant guidance from the city or state health department about screening children not eligible for Medicaid. If there is none, consider screening all children. Children should be tested at least once when they are 2 years of age or, ideally, twice, at 1 and 2 years of age, unless lead exposure can be confidently excluded. Pediatricians should recognize that measuring blood lead concentration only at 2 years of age, when blood lead concentration usually peaks, may be too late to prevent peak exposure. Earlier screening, usually at 1 year of age, should be considered where exposure is likely. A low blood concentration in a 1-year-old, however, does not preclude elevation later, so the test should be repeated at 2 years of age. Managed health care organizations and third-party payers should fully cover the costs of screening and follow-up. Local practitioners should work with state, county, or local health authorities to develop sensitive, customized questions appropriate to the housing and hazards encountered locally.

5. Be aware of any special risk groups that are prevalent locally, such as immigrants, foreign-born
adoptees, refugees, or children whose parents work with lead or lead dust in their occupation or hobby and, of course, those who live in, visit, or work on old houses.

6. In areas with old housing and lead hazards, encourage application for HUD or other moneys available for remediation.

7. Keep current with the work of the national Advisory Committee on Childhood Lead Poisoning Prevention and any relevant local committees. Although there is now evidence that even lower blood lead concentrations may pose adverse effects to children, there is little experience in the management of excess lead exposure in these children. Although most of the recommendations concerning case management of children with blood lead concentrations of 15 μg/dL should be appropriate for children with lower concentrations, tactics that decrease blood lead concentrations might be expected to be less and less effective as they are applied to children with lower and lower blood lead concentrations.

RECOMMENDATIONS FOR GOVERNMENT

1. Identify all children with excess lead exposure, and prevent further exposure to them. The AAP supports the efforts of individual states to design targeted screening programs, even for Medicaid children. However, the goal must be to find all children with excess exposure and interrupt that exposure, not simply to screen less. To do this, state and local government activities must focus on the children who are most at risk, which requires more and better data about the prevalence of elevated blood lead concentrations in specific communities. Prevalence estimates based on convenience samples or clinic attendees are not reliable and should not be used as the basis of policy.

2. Realize that case-finding per se will not decrease the risk of lead poisoning. It must be coupled with public health programs including environmental investigation, transitional lead-safe housing assistance, and follow-up for individual cases. Lead-screening programs in high-risk areas should be integrated with other housing and public health activities and with facilities for medical management and treatment.

3. Continue commitment to the Healthy People 2010 goal of eliminating lead poisoning by 2010. The AAP supports the current plan with emphasis on lead-safe housing. Continued monitoring and commitment will be necessary. Research findings on low-cost methods of remediating housing have become controversial. The federal government should support impartial scientific and ethical inquiry into the best way to carry out the needed research.

4. Minimize the further entry of lead into the environment. Regulations concerning airborne lead should be enforced, use of lead in consumer products should be minimized, and consideration should always be given to whether a child might come into contact with such a product.

5. Encourage scientific testing of the many simple, low-cost strategies that might decrease lead exposure. Examples include hand-washing and use of high chairs. Exploration of innovative, low-technology tactics should be encouraged, perhaps through the use of special study sections or review groups. Educational resources for parents and landlords need to be developed and tested.

6. Require coverage of lead testing for at-risk children by all third-party payers by statute or regulation.

7. Fund studies to confirm or refute the finding that blood lead concentrations of less than 10 μg/dL are associated with lower IQ. The next important step in lead research is conducting of studies in which confounding by socioeconomic factors is not so strong. Funding of studies in this area needs to be given high priority, as was done in the early 1980s when the question of effects of blood lead concentrations less than 20 μg/dL was raised.

8. Gather the nationally representative data necessary for a rational public health response to the problem of childhood lead poisoning. The federal government should continue measuring children’s blood lead concentrations in the National Health and Nutrition Surveys to allow national estimates of exposure and should periodically resurvey housing to measure progress in the reduction of lead-paint hazards. In addition, state governments can improve monitoring of trends among screened children by supporting electronic reporting of blood lead test results to the CDC.

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.
Chelating Agents

The single most important factor in managing childhood lead poisoning is reducing the child's exposure to lead. Several drugs are used in the treatment of lead poisoning. These drugs are capable of binding, or chelating, lead and depleting the soft and hard tissues of lead and thus reducing toxicity. All drugs have side effects and must be used with caution.

Children receiving chelation should NEVER be discharged until they can go to a lead-safe environment.

In children with blood lead levels greater than 44ug/dL, the Centers for Disease Control and Prevention (CDC) recommends chelation therapy. The chelating agents are listed below with a brief description of their actions and side effects.

For more comprehensive treatment guidelines, refer to Chapter 7 of the 1991 CDC Guidelines on Preventing Lead Poisoning in Young Children.

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>GENERIC NAME</th>
<th>ABBREVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemet</td>
<td>Succimer</td>
<td>DMSA</td>
</tr>
<tr>
<td>Calcium Disodium Versenate</td>
<td>Edetate disodium calcium</td>
<td>CaNa₂EDTA</td>
</tr>
<tr>
<td>Cuprimine</td>
<td>D-Penicillamine</td>
<td>D-Penicillamine</td>
</tr>
<tr>
<td>BAL* in Oil</td>
<td>Dimercaprol</td>
<td>BAL*</td>
</tr>
</tbody>
</table>

* British anti-Lewisite

**Succimer**: Can be administered on an out-patient basis if lead-safe housing is established. Selectively high for lead and low for essential trace metals. Administered PO. Side effects include: N/V, diarrhea and loss of appetite. See Appendix for more information on Succimer.

**CaNa₂EDTA**: Removes lead from extracellular compartment only, does not enter cells. Administered IV or IM.

**D-Penicillamine**: Enhances urinary excretion of lead. Not as effective as CaNa₂EDTA. Administered orally in capsule or tablets (125 mg and 250 mg). Side effects similar to penicillin sensitivity: rash, leukopenia, thrombocytopenia, hematuria, proteinuria, hepatocellular enzyme elevation and eosinophilia. Isolated reports of nephrotoxicity have been reported. Should not be administered to patients with a known sensitivity to penicillin.

**BAL**: Two molecules of BAL combine with one atom of heavy metal to form a stable complex. Administered IM. Side effects include: N/V, headache, GI distress.
CASE MANAGEMENT PROTOCOL

This document will outline the general framework and procedures to be used in conducting case management services for children with elevated blood lead levels (EBL). This protocol is applicable to the OCLPPP, its trained case managers, its funded sites, sponsored STELLAR sites and local health districts that have a current Memorandum of Understanding (MOU) with the ODH.

The ODH OCLPPP Case Management Coordinator will send notification of new open cases of children with EBLs to case managers in health districts that have a current MOU to enable them to proceed with case management services. In jurisdictions where there is no MOU, the OCLPPP Case Management Coordinator will take initial responsibility for the case. After the parent/guardian has signed a release of information form, local staff may provide follow up, if available.

The process of case management will be divided into six stages. These stages include: 1) initial contact; 2) first home visit; 3) home visit follow up; 4) second home visit; 5) home visit follow up; 6) case closure. The details of each stage are outlined below.

Stage 1: Initial contact

TIMETABLE FOR INITIAL CONTACT

<table>
<thead>
<tr>
<th>EBL LEVEL</th>
<th>TIME FRAME AFTER RECEIVING EBL LAB RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-14 µg/dl</td>
<td>Within 10 Business Days</td>
</tr>
<tr>
<td>15-19 µg/dl</td>
<td>Within 10 Business Days</td>
</tr>
<tr>
<td>20-44 µg/dl</td>
<td>Within 5 Business Days</td>
</tr>
<tr>
<td>45-70 µg/dl</td>
<td>Within 2 Business Days</td>
</tr>
<tr>
<td>70+ µg/dl</td>
<td>Within 1 Business Day</td>
</tr>
</tbody>
</table>

There is no safe level of lead in the blood. Ohio Administrative Code requires a public health lead investigation at confirmed blood levels ≥10 µg/dl. However, any jurisdiction with a current MOU with ODH that has chosen to provide primary prevention services to families of children with levels of 5-9 µg/dl, should make initial contact with these families within 20 business days.

The initial contact for 10-14 g/dl EBLs shall consist of a letter to parent/guardian including a notification of EBL and an educational packet on lead poisoning prevention and reduction. A home visit is recommended if resources allow for it.

The initial contact for EBL >15 g/dl EBLs shall consist of a phone call to parent/guardian including a notification of the EBL test, brief educational information about lead poisoning health risks and preventive measures and the scheduling of a first home visit.

All other case management team members shall be notified of the EBL within compliance to HIPAA guidelines. Other team members may include the public health lead investigator (PHLI), the primary care provider, local health district staff, and for Medicaid-eligible children, the Ohio Department of Job and Family Services (ODJFS) HealthChek coordinator.
Stage 2: First home visit

- Conduct with public health lead investigator during initial investigation if possible, but may be done separately.
- Administer medical and behavioral assessment using the Elevated Blood Lead Level Home Visit Questionnaire.
- Conduct an educational session with the parent/guardian with emphasis on information related to the medical, nutritional and environmental aspects of lead poisoning. Provide appropriate materials to the parent/guardian such as handouts, videos and cleaning supplies.
- Obtain parent/guardian signatures on release of information and consent forms for all appropriate referrals, e.g. Help Me Grow, WIC, BCMH and Early Learning Initiative. All children under the age of 36 months of age with a blood lead level >10 µg/dl shall be referred to Help Me Grow (Early Intervention).
- Conduct an exit summary with the parent/guardian on all lead hazard and remediation issues raised during the assessment process.
- Send a copy of the Home Visit Questionnaire and any related documents to the OCLPPP Case Management Coordinator via email, fax or postal mail.

Stage 3: First home visit follow-up

- Create an individualized Case Management/Care Plan with specific goals for the child in question.
- Complete Individualized Educational Assessment form based on information gathered during the first home visit and the PHLIs investigation.
- Distribute a copy of the Individualized Educational Assessment form to the parent/guardian and all other relevant team members.
- Make appropriate referrals to programs for which the parent/guardian has given consent.
- Coordinate efforts by all case management team members to implement the Case Management Care Plan.
- Schedule second home visit.

Stage 4: Second home visit

- Conduct within 45-90 days after the first home visit, ideally after the child has been retested and the results received.
- Home visit may be in conjunction with other team members as appropriate.
- Evaluate progress on the Case Management/Care Plan goals, such as obtaining follow up blood tests, lowered blood lead levels, improved cleaning habits and improved nutrition for child.
- Review and reinforce education session components from first home visit. Use encouragement and praise for progress in meeting Case Management/Care Plan goals.
- If a home visit is not feasible, a phone conversation with the parent/guardian may be substituted.
- Send a copy of the Home Visit Questionnaire and any related documents to the OCLPPP Case Management Coordinator via email, fax or postal mail.

Stage 5: Second home visit follow-up

- Send monthly due and quarterly overdue reminder letters for follow up blood lead tests to parent/guardian and primary care providers as necessary.
remediation is progressing and completed.
- Use follow up phone calls and/or visits to the parent/guardian to encourage continued reduction of blood lead levels. Highest priority shall be given to families of children with the highest EBLs.
- Continue to coordinate with other referred agencies. Children’s Services may be used as an additional resource for especially hazardous home environments as appropriate.

**Stage 6: Case closure**

Under normal circumstances, a case will be closed when:

- A child maintains blood lead levels below 10 µg/dl for six continuous months, determined by at least two confirmed blood tests less than 10 µg/dl.
- A child has reached the age of 72 months.
- The parent/guardian cannot be contacted within a nine-month period that includes three or more documented failed attempts to reach them.
- A child has not had any follow up blood tests within a twelve-month period.
- A child has moved to a different jurisdiction; in this situation all case notes, child reports and other information shall be sent to the case manager in the new jurisdiction. Utilize the Ohio Lead Case Managers & Local Health Department Contacts directory from the ODH OCLPPP to identify contacts in the child’s new health district. Send notification of the child’s new address to the OCLPPP Case Management Coordinator at ODH.

When a case is closed, a notification letter shall be sent to the parent/guardian (with a copy to the primary care physician), that also includes an information packet with suggestions for long-term care and prevention and an outline of the critical transition points in a child’s development that might be affected by lead poisoning. Send a copy of only the notification letter to the ODH OCLPPP Case Management Coordinator.

A case may remain open until a child becomes 16 years of age, based on the discretion of the case manager. This decision should be based on time constraints, resource availability and individual child considerations.
The Ohio Department of Health          http://www.odh.ohio.gov
Childhood Lead Poisoning Prevention Program
614-466-5332
1-800-LEADSafe
  • Public Health Lead Investigations
  • Surveillance Data
  • Follow-up with case management
  • PLANET Program
  • Regional Resource Centers
  • Ohio Lead Advisory Council
  • Statewide Bi-annual Conference

Lead Poisoning Prevention Program
1-877-NOTLEAD
  • HEPA Vacuum Loaner Program
  • Licensing of Inspectors, Risk Assessors, Workers, Contractors
  • Abatement
  • Clinical Lab Approval
  • Environmental Lab Approval
  • Abatement Product Approval

The Ohio Department of Job and Family Services          http://jfs.ohio.gov
Office of Ohio Health Plans
614-728-8476

American Academy of Pediatrics         http://aappolicy.aappublications.org

U.S. Environmental Protection Agency (EPA)         http://www.epa.gov

U.S. Department of Housing and Urban Development (HUD)         http://www.hud.gov/offices/lead

Centers for Disease Control and Prevention http://www.cdc.gov/Environmental

National Center for Healthy Housing         http://www.centerforhealthyhousing.org

Alliance for Healthy Homes         http://www.afhh.org

Children’s Environmental Health Network         http://www.cehn.org
# Signs and Symptoms of Lead Poisoning by Developmental Level

<table>
<thead>
<tr>
<th>Infancy and Toddlerhood</th>
<th>Preschool Years</th>
<th>Elementary School Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Excessive Crying, Whining, Fussiness</td>
<td>- Excessively Active</td>
<td>- Fails to Finish Class Assignments</td>
</tr>
<tr>
<td>- Colic</td>
<td>- Very Non-compliant</td>
<td>- Disruptive in Class</td>
</tr>
<tr>
<td>- Feeding Problems: Poor Sucking, Cries While Eating, Irregular Eating, Fussy Eater</td>
<td>- Difficulty in Toilet Training</td>
<td>- Poor School Performance</td>
</tr>
<tr>
<td>- Sleep Disturbances: Excessive/Little Sleep, Restless Sleep, Wakes Easily, Bedtime</td>
<td>- High Activity Levels</td>
<td>- Low Frustration Tolerance</td>
</tr>
<tr>
<td>Problems</td>
<td>- Impulsive</td>
<td>- Problem with Learning</td>
</tr>
<tr>
<td>- Very Sensitive/Reactive to Stimulation:</td>
<td>- Interrupts Others</td>
<td>- Frequently Calls Out in Class</td>
</tr>
<tr>
<td>Touch, Taste, Noise, Odors, Sounds</td>
<td>- Often Talks Excessively</td>
<td>- Problems with Peers/Friends</td>
</tr>
<tr>
<td>- Cries Excessively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Impossible to Soothe or Comfort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Difficult to Care For</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Little Smiling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Irritable, Cranky, Non-compliant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Late in Babbling First Words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Parents May Not Interact with Child</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Many of these symptoms may also indicate other health conditions and learning behavior problems.

Prepared by the Pennsylvania State University Extension System by Phyllis Adams-Barner, Ph.D. through the cooperation of the University of Connecticut Cooperative Extension System.
EDUCATION

Each of the topics under Education should be discussed with the family.

Anticipatory Guidance
- Discuss during prenatal care and during preventive care at 3-6 and 12 months of age.
- Discuss sources of lead including paint, soil, household dust, food, water and ethnic remedies.
- Discuss health effects; chronic exposure can interfere with the CNS, kidneys and hemoglobin synthesis.
- Discuss hazards associated with renovating/remodeling homes built before 1978.

Sources of Lead
- Deteriorating lead-based paint
- Parent's job or hobby
- Ethnic remedies
- Food and water
- Soil and dust
- Toys

Pathways of Exposure
- Ingestion (normal hand-to-mouth activity)
- Inhalation

Signs/Symptoms/Effects
- Lead poisoning often has no symptoms
- Symptoms may mimic flu
- Speech/hearing impairments
- Difficulty learning
- Slowed growth
- Short attention span

Childhood Risk Factors
- Rapidly developing central nervous systems
- Normal hand-to-mouth activity
- Absorb more lead due to higher metabolism

Cleaning to Reduce Exposure
- Damp dust and wet mop
- Avoid sweeping/use vacuum with HEPA filter
- Clean weekly with detergent
- If working with lead, wash work clothes separately
- Create safe play areas; place a clean blanket on the floor and don't allow children to play on bare soil

Reduce Access to Lead
- Block areas that have deteriorating lead-based paint
- Cover bare soil with grass
- Remove shoes before entering the house or use a rug at doorway
- Wash hands often
- Wash toys/pacifiers
**Nutrition**
- High calcium and iron diet
- Diet low in fat
- Regular meals with healthy snacks

**Medical Management**
- Developmental milestones and signs of delay in development
- Iron levels and preparing foods rich in iron
- Removing the child from source of exposure

**Diagnosing**
- Venipuncture
- Capillary blood collection (ear, heel, finger)

**Environmental Inspection ≥ 15 µg/dL**
- The state or local health department will schedule an appointment with the family to inspect the home to identify possible sources of exposure. Owner will receive a written recommendation for hazard reduction.
Educational Assessment for Lead Poisoning

Child Name ______________________
Parent Name _____________________
Date ___________________________

Discussed sources of lead in the home and environment
- Lead-based paint
- Soil
- Hobbies
- Occupations
- Other sources (toys, jewelry, home folk remedies)

Caregiver expresses understanding of sources for lead exposure.       yes   no

Discussed health and developmental problems lead poisoning can cause in children
- Hyperactivity
- Hearing loss
- Language deficiency
- Aggression
- Seizure
- Death
- Others __________________________________________

Caregiver expresses understanding of health and developmental problems.  yes   no

Discussed purpose of blood testing for lead
- The blood test is the only way to determine if your child has lead poisoning.
- There is no safe level of lead in the blood.

Caregiver expresses understanding of blood lead testing.      yes   no

Discussed child’s blood lead level and treatment recommended at this level

Caregiver expresses understanding of child’s lead level and treatment.       yes   no

Discussed steps caregiver can take to reduce lead hazards and child’s lead ingestion
- Knowing the sources of lead in the child’s environment
- Household cleaning techniques
- Hand washing
- Nutrition

Caregiver expresses understanding of immediate and ongoing steps to be taken to aid in reducing child’s lead exposure and absorption.       yes   no

Discussed services available to assist with child’s developmental concerns
- HMG
- BCMH
- OTHER ________________________________

Caregiver expresses knowledge of available resources.      yes   no

Provided caregiver with an educational brochure on lead poisoning prevention
Wear old clothing that can be washed.

**D A N G E R !**

Pregnant women must NOT clean up lead dust. The dust can harm the developing baby.

Keep children away from the cleaning area.

**D O NOT** smoke or eat while cleaning.

For more information on healthy homes before you start

Contact your local health department

Ohio Department of Health
1-877-LEAD-SAFE
http://www.odh.ohio.gov

U.S. Environmental Protection Agency (EPA)
http://www.epa.gov

Centers for Disease Control and Prevention
http://www.cdc.gov/environmental/

U.S. Department of Housing and Urban Development (HUD)
http://www hud.gov/offices/lead/healthyhomes/

National Center for Healthy Housing
http://www nchh.org

Alliance for Healthy Homes
http://www afhh.org

Poison Control Center
1-800-222-1222

Vacuum Loaner Program
Residents can borrow vacuum cleaners from various local state organizations. For more information and a list of locations, visit http://www.odh.ohio.gov (keyword search = vacuum loaner program).

Ohio Childhood Lead Poisoning Prevention Program
John Belt, Program Administrator

OHIO CHILDHOOD LEAD POISONING PREVENTION PROGRAM
246 North High Street
Columbus, OH 43215
(614) 466-5332
1-877 LEADSSAFE
http://www.odh.ohio.gov
bjfhs@odh.ohio.gov
SUPPLIES CHECKLIST:
- Plastic or rubber gloves
- Plastic trash bags
- Lint free disposable rags
- A spray bottle filled with water
- 2 Plastic buckets or 1 divided bucket
- A mop with washable or disposable cloths
- Water and cleanser
- A HEPA vacuum - common household vacuums will spread lead dust into the air

PREPARE THE AREA:
- Wearing gloves, pick up large paint chips found on floors, porches, and other areas around the home
- Place the chips in a plastic bag
- Remove smaller paint chips by spraying them with water before sweeping them up with a broom. Dry sweeping will spread lead dust around
- Seal the plastic bag
- Place bag in garbage

WHOLE HOUSE CLEANING:
- Wear plastic or rubber gloves
- Fill one side of the two-sided bucket with water and cleanser
- Fill one side with water only
- Clean from the ceiling to the floor with rags. Start at the farthest corner of the room and work towards the door
- Wash all surfaces with the detergent
- Change detergent water and rags frequently
- Pour used water and cleanser down the toilet. Avoid throwing in sinks, bathtubs, and yards.
- Mop one area in a room at a time by using cleanser water, followed by fresh rinse water
- Change both rinse and cleanser water often
- Change mop cloth with each room change

CARPETS AND VACUUMING:
Use a vacuum with true HEPA filtration. This will keep the lead dust from being released back into the air. Many local health departments or housing authorities have HEPA vacuums to loan out at no cost.
- Clean from top to bottom, vacuum furniture and drapes first
- Very slowly vacuum carpeting and area rugs
- Flip rugs over and vacuum the other side as well
- Throw rugs may be separately washed in a washing machine
- Change vacuum cleaner bags/canisters outside the home

**If possible, remove carpeting. Hard floor surfaces are easier to keep clean.**

Cleaning up lead dust is a short term safety method.

Removing the source of the lead dust is needed to keep your family safe from lead dangers.

**Lead can easily find its way into a child’s mouth through a child’s normal hand-to-mouth activity such as eating, thumb sucking, chewing on toys, or books.**

Pets can track in lead from outside in the yard or on the porch. It can be on their fur and paws.
Epidemiologic studies of children show that those exposed to lead, even low levels of lead, may have a lower IQ, learning disabilities, behavioral abnormalities and kidney damage. Cognitive and growth defects also may occur in infants whose mothers are exposed to lead during pregnancy. Lead intoxication is a widespread problem. One of every nine children under six years of age has blood lead levels high enough to be at risk. In 1970, an estimated 3 million children aged less than 6 years had blood lead levels associated with adverse health events. Children in older, inner-city neighborhoods are more likely to be affected, but children in suburban and rural areas are at risk too.

There is currently no lead level believed to be safe for infants and young children. The Centers for Disease Control (CDC) define blood lead levels of 10 mcg/dL as toxic. The previous level, set in 1985, was 25 mcg/dL. The new federal definition was established in 1991 as evidence accumulated indicating that serious consequences occur in infants and young children at levels greater than 10 mcg/dL. In lead poisoning, there is a silent progression of nonspecific symptoms which makes it difficult to detect. Irritability, stomachache, diarrhea, colic, distractibility and lethargy are all symptoms of progressive lead accumulation. Higher levels or chronic exposure results in more severe symptoms such as kidney and nervous system damage.

Sources of Lead

Although lead-containing paint was banned for residential use in the United States in 1978, residual paint on older buildings is the most frequent source of lead exposure in young children. But, a variety of other substances contribute to lead poisoning. Paints used in industry or on equipment or in playgrounds or parks may still contain lead. Tap water can be
contaminated by lead pipes, copper pipes with lead solder or bronze and brass faucets containing lead. Automobile exhaust from leaded gasoline, factory emissions and pesticides contribute to both air and soil lead pollution. Lead exposure can also result from lead crystal and poorly glazed ceramic dishware. The Food and Drug Administration (FDA) sets strict limits for the lead content on products made or sold in the United States, but other countries may have higher limits or no limits at all. Ceramic dishware produced outside the United States, china and lead crystal can leach dangerous amounts of lead into food. Occasional servings of food from these products is acceptable; food storage is unsafe. Food can also be contaminated with lead when it is grown in soil with a high lead content or when plants are sprayed with insecticides containing lead.

**Nutrition**

Proper nutrition is important in the prevention of lead poisoning, especially in young children. A balanced diet of grains, fruits, vegetables, dairy products and selections from meat, poultry, fish, dry beans, nuts or eggs can help decrease susceptibility to lead intoxication. It is particularly important to include adequate amounts of calcium and iron.

**Iron**

Anemia, a decrease in the quantity or quality of red blood cells, occurs most frequently due to a deficiency of iron. Iron deficiency results in a decrease in the normal quantity of hemoglobin, the protein which carries oxygen in the blood. Lead poisoning can mimic iron deficiency. In fact, lead intoxication can also cause anemia. The occurrence of iron deficiency and lead poisoning simultaneously can be synergistic and devastating. Anemia is more severe in these children and up to 50 percent more lead may be absorbed in children with an iron deficiency than in those with normal hemoglobin levels. Children who are most likely to be exposed to lead are likely to have other risk factors, such as a poor diet, which can contribute to iron deficiency.

The Recommended Dietary Allowance (RDA) for iron for children from age 6 months to 10 years is 10 mg per day. Substantial amounts of iron are found in fortified cereals, meat, legumes, prunes, raisins and green leafy vegetables. The following table lists the iron content of some representative foods. The absorption of iron in foods will be enhanced when iron-rich foods are consumed with foods high in vitamin C.

**Amount of Iron in Foods**

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving Size</th>
<th>Iron (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ground beef, lean, baked</td>
<td>3.5 oz</td>
<td>2.09</td>
</tr>
<tr>
<td>ham, lean, roasted</td>
<td>3.5 oz</td>
<td>1.48</td>
</tr>
<tr>
<td>chicken, roasted, no skin</td>
<td>3.5 oz</td>
<td>1.21</td>
</tr>
<tr>
<td>kidney beans, boiled</td>
<td>1 cup</td>
<td>5.20</td>
</tr>
<tr>
<td>spinach, boiled</td>
<td>1 cup</td>
<td>5.20</td>
</tr>
<tr>
<td>broccoli, raw</td>
<td>1 cup</td>
<td>0.78</td>
</tr>
</tbody>
</table>
Green leafy vegetables may absorb lead from soil where exposure is high, such as near freeways or main roads and near lead smelting plants. Contaminated dirt from the garden can add to lead in the diet if vegetables are not well washed before consumption. If a home garden is desired and the property is in or near an area of high exposure, soil should be tested before planting.

**Calcium**

An adequate calcium intake can protect against lead poisoning. It has been observed in animals and humans that both the absorption and retention of lead decreases as calcium intake increases. Many children at risk for exposure to excess lead are also those who live at the poverty level, and may consume a diet with insufficient calcium. Therefore, increasing consumption of low-cost calcium rich foods can reduce the severity of the effects of lead exposure.

The RDA for calcium for children ages 1 to 10 is 800 mg per day. Calcium rich foods include milk, cheese, yogurt, leafy green vegetables, beets, broccoli, and legumes. Suggested amounts of some foods which would provide the RDA for calcium are listed in the following table.

**Good Food Sources of Calcium**

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving size to = 800 mg milk 2.5 cups</th>
</tr>
</thead>
<tbody>
<tr>
<td>milk</td>
<td>2.5 cups</td>
</tr>
<tr>
<td>swiss cheese</td>
<td>3 ounces</td>
</tr>
<tr>
<td>american cheese</td>
<td>4.5 ounces</td>
</tr>
<tr>
<td>cheddar cheese</td>
<td>4 ounces</td>
</tr>
<tr>
<td>broccoli</td>
<td>4.5 cups</td>
</tr>
<tr>
<td>spinach, cooked</td>
<td>3.25 cups</td>
</tr>
<tr>
<td>turnip greens, cooked</td>
<td>4 cups</td>
</tr>
</tbody>
</table>
Fat Intake

Growing children need adequate amounts of energy and nutrients to support growth. Dietary fat is an important source of kilocalories for this age group. But, fat should be consumed in moderation because of the potential contribution of excess dietary fat to long-term health concerns. It also has been suggested from animal studies that excess dietary fat may enhance lead absorption.

Following the new food pyramid will provide a child with a well balanced diet which includes sufficient fat to support growth without supplying an excess. Children should be offered fruits and vegetable sticks with peanut butter, iron fortified breads and cereals, pudding or cheese instead of chips and candy for snacks.

Water

The risk of ingesting excess lead intoxication from tap water can be reduced by running the COLD water faucet for at least one minute before using it for drinking, cooking or cleaning food. This should be done whenever the faucet has not been used for several hours. The water from the one minute flushing can be used for watering plants or washing dishes. Taking this precaution can significantly reduce exposure in infants who are bottle fed formula mixed with water.

For more information on lead, see HYG Fact Sheets #1149-93, "Lead in the Garden" and #5537-93, "Lead in the Home."
1. Primary prevention of childhood lead poisoning begins before birth

2. All pregnant women should be given anticipatory guidance about potential lead exposure

3. A risk assessment questionnaire (appendix) may be useful in identifying areas of risk reduction for counseling

4. Recommendations for women with affirmative responses
   a. Any children in the household should have a blood lead test
   b. Provide information on environmental sources of lead and how to reduce or eliminate exposure
   c. Provide nutrition counseling to reduce absorption of ingested lead
      i. Eat frequent and regular meals. Environmental lead is more easily absorbed on an empty stomach
      ii. Increase the amount of iron and calcium in diet
         a. Iron - lean red meat, poultry, fortified breads & cereals, cooked legumes (dried beans/peas), spinach
         b. Calcium—milk, yogurt, cheese, cooked greens, calcium fortified orange juice
   d. Refer the woman to the Office of Safety and Health Administration if occupational exposure is suspected
   e. Assessment of maternal blood lead levels in asymptomatic pregnant women solely on the basis of an affirmative response is not recommended
      i. There are no guidelines regarding medical treatment for women with elevated blood lead levels during pregnancy
      ii. There are no guidelines that quantify fetal risk on the basis of maternal blood lead levels

*ODH medical guidelines are pending Federal Centers for Disease Control recommendations.

References:
The State of New York Health Department (http://www.health.state.ny.us/nysdoh/leadhandbook/phc10.htm)
The State of Minnesota Health Department
### Prenatal Risk Assessment Questions for Lead

1. **Sometimes pregnant women have the urge to eat things which are not food, such as clay, soil, plaster or paint chips.**
   
   Do you ever eat or chew on non-food items?  
   - YES  
   - NO  

2. **Do you live in or regularly visit an old house (built before 1950) with ongoing renovations that generate a lot of dust (e. g. sanding, scraping)?**  
   - YES  
   - NO  

3. **Do you live in or regularly visit an old house (built before 1950) that has peeling, chipping, dusting or chalking paint?**  
   - YES  
   - NO  

4. **Do you have children in the household with lead poisoning?**  
   - YES  
   - NO  

5. **Do you have a history of lead poisoning?**  
   - YES  
   - NO  

6. **To your knowledge, has your home been tested for lead in the water, and if so, were you told that the level was high? (>15 parts per billion (ppb) or micrograms per liter (mcg/L) is considered high.)**  
   - YES  
   - NO  

7. **Do you use non-commercially prepared pottery or leaded crystal?**  
   - YES  
   - NO  

8. **Do you or others in your household have an occupation (see below) involving lead exposure?**  
   - YES  
   - NO  

<table>
<thead>
<tr>
<th>Lead abatement</th>
<th>Use of lead-based paints</th>
<th>Home renovation/restoration</th>
<th>Metal scrap yards/other recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing/installation of</td>
<td>Brass/copper</td>
<td>Glass recycling, including</td>
<td>Occupations using firearms</td>
</tr>
<tr>
<td>plumbing components</td>
<td>foundry</td>
<td></td>
<td>stained glass</td>
</tr>
<tr>
<td>Firing range work</td>
<td>Pottery making</td>
<td>Production/use of chemical</td>
<td>Bridge, tunnel and elevated highway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>preparations</td>
<td>construction</td>
</tr>
<tr>
<td>Motor vehicle parts and</td>
<td>Automotive repair shops</td>
<td>Industrial machinery</td>
<td>Battery manufacturing/repair</td>
</tr>
<tr>
<td>accessories</td>
<td></td>
<td>manufacturing</td>
<td></td>
</tr>
</tbody>
</table>

9. **Do you use any traditional folk remedies or cosmetics (see below) that are not sold in a regular drug store or are homemade, which may contain lead?**  
   - YES  
   - NO  

- Alkohl (kohl, surma)  
- Azarcon (reuda, liga, coral, altercon, maria luisa)  
- Bali goli  
- Ghazard  
- Greta  
- Pay-loo-ah  

10. **Do you or others in your household have any hobbies or activities likely to cause lead exposure (see below)?**  
    - YES  
    - NO  

<table>
<thead>
<tr>
<th>Scraping, sanding, or burning lead-based paint on household structures or furniture</th>
<th>Making or painting on stained glass</th>
<th>Copper enameling</th>
<th>Bronze casting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Making pottery/ceramic ware with lead glazes/paints</td>
<td>Casting ammunition, fishing weights or lead figurines</td>
<td>Collecting, painting, or playing games with lead figurines</td>
<td>Jewelry making with lead solder</td>
</tr>
<tr>
<td>Electronics with lead solder</td>
<td>Print making (using lead white, flake white, and chrome yellow pigments)</td>
<td>Liquor distillation</td>
<td>Hunting and target shooting</td>
</tr>
</tbody>
</table>

**Yes response** = please refer patient to one of the Ohio Lead Regional Resource Centers (RRC) for education.  
Northwest RRC = 1-800-698-3691  
Southwest RRC = 1-800-957-3810  
Eastern Ohio RRC = 1-866-887-6779 ext. 138